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PROGRAMING CREATIVE BEHAVIOR.
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THE EXTENT THAT AUTOINSTRUCTIONAL AIDS CAN BE APPLIED TO THE INSTRUCTIONAL SETTING TO (1) PROVIDE FOR DELIBERATE DEVELOPMENT OF STUDENTS' CREATIVE BEHAVIOR AND (2) ASSURE MASTERY OF SUBJECT MATTER AT THE SAME TIME WAS THE SUBJECT OF THIS STUDY. THE STUDY POPULATION CONSISTED OF HIGH SCHOOL SENIORS WHO INTENDED TO CONTINUE THEIR FORMAL EDUCATION AFTER GRADUATION. STUDENT GROUPS WERE MATCHED ON THE BASIS OF INTELLIGENCE. THE PATTERN OF RESULTS ON VARIOUS TESTS OF CREATIVE ABILITY SHOWED THAT INSTRUCTOR-TAUGHT PROGRAMED GROUPS WERE SUPERIOR TO THOSE WHO TOOK THE PROGRAM WITHOUT INSTRUCTORS AND TO THE CONTROL GROUPS WHO RECEIVED NO PROGRAMED INSTRUCTION. (LP)

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Programming Creative Behavior

SIDNEY J. PARNES

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
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State University of New York at Buffalo
Buffalo, New York 14214
and
Research Foundation of State University of New York
Albany, New York 12224

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It would be impractical to try to acknowledge all of those who helped carry out the project; however, I would be remiss to fail to acknowledge the following:

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In spite of the large number of persons who were so helpful, I must obviously take full responsibility for any shortcomings in the final product--I cannot place this responsibility on a group.

Sidney J. Parnes
Principal Investigator
August 31, 1966

TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS ii

ABSTRACT iv

I. THE PROBLEM 1

II. OBJECTIVES OF THE RESEARCH 15

III. PROCEDURE 17

IV. THE EXPERIMENTAL METHOD 21

V. FINDINGS 29

- A. Summary 29
- B. Detailed Statistical Analyses of Data 31
- C. Analysis of Student Reactions 42

VI. DISCUSSION 55

REFERENCES 60

APPENDICES 66

- A - A Counselor's Comments Regarding Experimental Course
- B - A Proposal to Buffalo Public High Schools
- C - Initial Letter to School Principals
- D - Agenda for Auditorium Meetings of Prospective Subjects
  - Di - An Explanation of the Experiment in Creative Problem-Solving Education
  - Dii - Comments by S. J. Parnes to Prospective Subjects
  - Diii - Comments by Dorothy Erismann to Prospective Subjects
  - Div - Comments by the School Principals
  - Dv - Questionnaire--for Prospective Subjects
- E - Letters to Board of Education and Volunteers
- F - Course Content
  - Fi - Introduction to Course--for All Students
  - Fii - How to Use These Self-Instructional Aids--for Program-Alone Students
  - Fiii - Summary and Review Card
  - Fiv - Titles of Sessions
  - Fv - Five-Minute Test-Exercises
  - Fvi - Special Instructions during Certain Sessions
  - Fvii - Absentee Form
- G - Questionnaire--for Experimental Students
- H - Final Letters to Principals and Volunteers
- I - Supplementary Tables

ABSTRACT

Purpose. The present research to develop auto-instructional materials capable of developing creative behavior in students (based on materials developed in a creative problem-solving course) is the first stage of a contemplated long-range period of research activity designed to ascertain the following: To what extent can auto-instructional materials provide for deliberate development of students' creative behavior and at the same time assure mastery of subject matter? The total project would thus couple the creative trend in American education with the requisite acquisition of course content.

The objectives of the research were: (a) to determine, by the use of experimental and control subjects, whether or not subjects receiving creative problem-solving training by programmed methods alone show increases in creative ability to the same extent as do subjects receiving the same error-free programmed materials by instructor-taught methods, and whether or not either or both of these groups show a significant gain in creative ability when compared with control subjects receiving no training; and (b) to study the attitudes toward the course of students taking the programmed version alone as compared with those receiving the programmed materials via an instructor.

Procedure. The population consisted of high-school seniors who intended to continue their formal education after graduation. The majority of those eligible volunteered for the experiment. All were students in the academic high schools of the Buffalo Public Schools.

Three groups of 62 subjects each (randomly selected from 1,086 who requested to be included in the experiment) were matched on the basis of the Lorge-Thorndike I.Q. The first group consisted of experimental subjects taking the program with an instructor; the second group was made up of experimental subjects taking the program alone; the third group served as a control, receiving no training between the pre-tests and post-tests that were given to all three groups.

One week--two full periods--was used for the battery of eleven psychological pre-tests for all three groups. Then thirteen weeks--two periods per week--were used for the course for the two experimental groups. Students were assigned to classes, in their own high schools, during their study periods. Each class met twice a week during the entire semester. There was no required outside work. Finally, one week--two full periods--was used for the

battery of eleven psychological *post-tests* for all three groups.

Six different schools were used to prevent contamination--i. e., to eliminate discussion between groups--and to minimize possible replication error. However, additional "in-the-same-school" control groups were also used for comparison purposes. Since there turned out to be no evidence of contamination, the results to be reported include these "in-the-same-school" comparisons.

The logic of the experiment required the use of three separate analyses, each with a two-by-three factorial design. Analysis-of-variance and -covariance techniques were employed.

Results and Conclusion. The experimental students, on almost every test, made greater gains than did the control students. In almost all of the measures, the gains of the instructor-taught programmed-groups were significantly superior to that of both control groups. In the case of the groups who took the program alone, the students were significantly superior to the control students in gains on most tests, but not to as large a degree. In other words, the instructor-taught groups tended to be more *markedly and consistently* superior to the control groups than did the students who had the program without an instructor.

In summary, the pattern of results on the various tests of creative ability permits the generalization that the instructor-taught programmed-groups were superior to those who took the program alone and to both control groups; and the groups that took the program alone were superior to both control groups. The tests most representative of this outcome were Planning Elaboration, Product Improvement Fluency, and Product Improvement Flexibility; and Alternate Uses, Other Uses, Product Improvement Originality, and Consequences Total gave essentially the same pattern of results.

With respect to student reactions to the course, the instructor-taught students found the course more interesting and felt they gained more from it; however, *both* groups appeared to report equal application of what they had learned and seemed to feel they would apply it equally as well in the future.

Further Plans. Further analyses will be made of the present data and of further pilot data collected during the project. Additional research is also planned on related aspects of the problem. Manuals are being developed regarding use of the programmed materials.

I. THE PROBLEM

Discussion of the problem includes treatment of several pertinent aspects: definition of creativity; the significance of creative ability in education; research on development of creative behavior; effect of programming on creative development; research on programming for creative development; implications for basic research.

INTRODUCTION. The present research to develop auto-instructional materials capable of developing creative behavior in students (based on materials developed in a creative problem-solving course) is the first stage of a contemplated long-range period of research activity designed to ascertain the following: To what extent can auto-instructional materials provide for deliberate development of students' creative behavior and at the same time assure mastery of subject matter? The total project would thus couple the creative trend in American education, advocated by leading educators, with the requisite acquisition of course content.

In later stages, it is anticipated that incremental programs which already exist in subject-matter courses will be modified in such a way as to permit their integration with creative thinking principles and procedures.

A substantial foundation for the present project had already been provided at the State University of New York at Buffalo, where the principles and procedures of creative problem-solving had been developed and taught for over twelve years. During the latter half of this time, the validity of these principles and procedures had been scientifically confirmed by research projects at this University and at a number of other institutions of higher learning. The specific purpose of the present research, the first stage of the contemplated long-range project, was to program these evaluated principles and procedures.

CREATIVITY DEFINED: Creative behavior is herein defined as behavior which demonstrates both uniqueness and value in its product. The product may be unique and valuable to a group or organization, to society as a whole, or merely to the individual himself. Thus, in behavioristic terms, creative behavior is: (1) a response, responses, or pattern of responses which operate upon (2) internal and/or external discriminative stimuli,usually called things, words, symbols, etc., and (3) result in at least one unique combination that reinforces the response or pattern of responses. In general, such creative behavior may be classified as discriminative, manipulative, and evaluative.

Creativity is thus a function of knowledge, imagination, and evaluation. Bruner (1962) describes learning as encompassing "acquisition, transformation, and evaluation." He is referring to creative learning, --not learning in the usual sense of the word. Conant (1963) emphasizes the need for better knowledge on the part of teachers, more acquisition. Without knowledge, there can obviously be no creativity. But, as Whitehead (1929) emphasized long ago, education should aim at "the effective utilization of knowledge." Conant argues particularly for the tools; Bruner and Whitehead emphasize all three elements involved in learning.

By way of analogy, we might consider the kaleidoscope, wherein the more pieces we have in the drum, the more possible patterns we can produce. Likewise, in creative learning, the greater our knowledge, the more patterns, combinations, or ideas we can achieve. However, as in the kaleidoscope, merely having the knowledge, the bits and pieces, does not guarantee the formation of new patterns. In the kaleidoscope it requires the revolving of the drum; in the mind it requires the manipulation of knowledge, the combining and rearranging of facts into new patterns in the form of ideas. The effectiveness of creative productivity also depends, of course, on the evaluation and development of the embryonic ideas into usable ideas.

Without knowledge, imagination cannot be creatively productive. With abundant knowledge, but without manipulation thereof, we again achieve no worthwhile creativity. Even with both imagination and knowledge available, but without the ability to evaluate, synthesize, and develop our potential ideas, we again achieve no effective creativity. Thus, creative productivity is a function of knowledge, manipulated, evaluated, and effectively developed into usable ideas.

Torrance and Harman (1961) found that students used knowledge more creatively when it was learned with a "creative set" rather than with a "memory set." Students with the "memory set" were more restricted in finding new implications or more applications for the knowledge. Hyman (1962) finds that information, as such, may not be as important to creativity as the way one seeks and receives it--as well as how he deals with it.

SIGNIFICANCE OF CREATIVE ABILITY IN EDUCATION: Teachers show an increasing awareness of the need and the opportunity for encouraging creative behavior (Miel, 1961; Zirbes, 1959). However, in spite of this in-

increasing concern, our present educational system, to a large extent, still overlooks the intentional enhancement of creative ability in students. Although there is much emphasis on creative teaching (creative films, demonstrations, and other creative approaches to teaching), relatively less is being placed on teaching for the development of creative behavior as defined above. Most instructors would be hard put to tell what their courses do, specifically and deliberately, to develop this behavior.

Harold Rugg (1963) writes, "We have had millions of hours devoted to training in solving problems by reasoning, but almost none devoted to cultivation of the imagination." And yet, Jerome Bruner (1960) states, "It is my hunch that it is only through the exercise of problem-solving and the effort of discovery that one learns the working heuristic of discovery . . ." What is unclear, he thinks, is what kinds of training produce the best effects.

Williams (1963), summarizing a variety of investigations, states that these studies have been consistent in their findings about the frequency of certain behaviors between teachers and pupils. Approximately one-quarter to one-half of the total classroom time was spent in telling students what to do. Another quarter was spent in providing information, much of it administrative. Only five per cent was devoted to reinforcement of the students' responses. (Reinforcement for creative responses was almost completely lacking.) In addition, the teachers allotted only about one-and-one-half per cent of the classroom time to decision-making functions.

And yet, Torrance (1960) states that more effective teachers in experimental mathematics courses (SMSG) noted more hypothesis-making and evaluative thinking than did less effective teachers. H. F. Harding (1963) emphasizes that students must learn the skills of inquiring, imagining, incubating, expressing, selecting, and evaluating.

Several studies have shown that abilities needed in typical academic activities are relatively independent from the abilities needed in creative activities (Holland, 1959, 1962; Holland and Astin, 1961; MacKinnon, 1962a, 1962b; Taylor, 1958a, 1964; Taylor and Barron, 1963; Taylor and Holland, 1964; Taylor, Smith, Ghiselin, and Ellison, 1961). Investigations also indicate that creative-thinking ability does contribute to achievement as it is currently measured (Parnes and Harding, 1962; Schmadel, 1960).

The importance of the planned development of creative behavior is becoming more and more apparent to leaders in all walks of life. Irving Taylor (in P. Smith, 1959) reports that a committee of 17 leading psychologists placed creativity and its cultivation at the top of a list of areas deserving the highest research priority in the behavioral sciences.

Frank A. Howard, Chairman of the Sloan-Kettering Institute for Cancer Research, emphasized the urgency when he cited the fact that, in inventiveness, the United States ranks near the bottom of the list of established industrial countries, compared with the size of its population.[1]

The U. S. Department of Commerce has proposed extensive plans to assist university training in innovation. Daniel V. De Simone (1963) includes the following statement in his summary of a division meeting: "The basic techniques of invention and innovation . . . ought to be, but are not, among the fundamentals generally taught in the engineering and business schools." The same should be true for students of all schools.

Preparation for Change: As we all know, change is bewilderingly rapid in our present nuclear and space age--far more rapid than ever before. The discoveries and innovations of the next 20 years will probably make the accomplishments of the previous 100 years seem to have progressed at a snail's pace. Therefore, no student can foresee exactly what knowledge he later will need to meet his life's problems. He must be helped to develop the attitudes and thinking abilities which will enable him to meet any future problem with imagination as well as judgment.

Furthermore, Maslow (1954) emphasizes that the need for self-actualization is a healthy man's prime motivation. He says, "What a man can be, he must be." Education for creativity-development can help achieve that goal.

RESEARCH ON DEVELOPMENT OF CREATIVE BEHAVIOR: Research on development of creative behavior has been conducted on an increasing scale ever since the presidential address of J. P. Guilford (1950) to the American Psychological Association. He emphasized the "appalling neglect" of the study of creativity, indicating that of some 121,000 titles indexed in Psychological Abstracts from its beginning until 1950, only 186 were definitely related to that subject.

In the summer of 1958, the Creative Education Foundation, located in

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[1] Reported in the Buffalo Evening News, October 19, 1960, page 70.

Buffalo, published the first "Compendium of Research on Creative Imagination," covering 30 studies concerned with the identification and development of creative ability. This comprised recent studies found in the literature at that time. Then, within approximately 18 months, 30 new research efforts were reported and summarized in a second Compendium. This also listed 28 additional research projects that had just been started--or about double the number apparently under way when the first Compendium was prepared.

Identification versus Development: Until the time of the first Compendium, projects dealt mainly with the identification of creative behavior. About half the studies reported in the second Compendium were devoted to the deliberate development of creative productivity, whereas only two such experiments were reported in 1958. Currently, the staff at SUNY/B is compiling a third Compendium covering the period from 1960 to 1965. A geometrically-increasing number of studies have already been discovered that deal with the development of creative behavior. Another indication of the magnitude of investigative effort in the general subject of creativity is that 186 dissertations were completed between 1960 and 1964, with another 133 already reported from 1965 to the present.

At least six research projects discussed by the Research Conference on Creativity at the University of Utah have indicated that creative ability can be measurably enhanced by planned cultivation (in C. W. Taylor, 1959). Additional studies have recently supported the earlier findings (Parnes, 1960; Taylor, 1964a, 1964b; Taylor and Williams, 1966). Research has also indicated that creative behavior can be nurtured by a more creative type of teaching and by deliberately providing for creativity-development in existent courses (Sommers, 1961; Torrance, 1960).

Hutchinson (1962) trained teachers to modify their teaching methods so as to include tasks involving cognition, divergent thinking, and evaluation, thus having the student participate in a wide range of thought processes. When compared with students taught under traditional methods, the experimental groups (especially those of low and middle intelligence) showed greater gains in achievement and greater mastery of subject matter. Knight (1962) has also demonstrated that students can be trained to become more fluent, flexible, and original in their thinking while they are acquiring factual knowledge.

Meinz (1960) found that a course in industrial art education for students majoring in elementary education led to significant increases on nine measures of a battery of creativity tests. The students revealed greater independence and a greater degree of self-involvement in their projects than did the control group of comparable students who had not received the course. Hoffa (1959) reported that art experience leads to increased independence of judgment. Burgart (1961) found significant positive relationships among art experience, measures of general creativity, certain personality variables, and aesthetic performance.

Consistency of Findings: Research findings consistently demonstrate that creative behavior can be significantly stimulated by deliberate treatments. Thus, there is a confirmation of the conviction expressed over ten years ago by Guilford (1952): "Like most behavior, creative activity probably represents, to some extent, many learned skills. There may be limitations set on these skills by heredity; but I am convinced that through learning one can extend the skills within those limitations."

In the same vein, Maltzman, Simon, and Licht (1959), at the University of California, summarized a group of research studies on originality-training by asserting that the results support the hypothesis that ". . . originality is a learned form of behavior which does not differ in principle from other forms of operant behavior." Using training procedures in free association, Maltzman produced highly reliable increases in the uncommonness of subjects' responses on two different tests.

Detailed information about creativity research is available in a wide variety of sources (Taylor, 1956, 1958, 1959, 1964a, 1964b; Taylor and Williams, 1966; Golann, 1963; Torrance, 1959, 1962, 1963; Stein and Heinz, 1960; MacKinnon, 1961; Gardner, 1964; Barron, 1963; Parnes, 1958, 1960; Parnes and Harding, 1962; Benton, 1961; Getzels and Jackson, 1962).

Research Questions: Five major types of questions are studied in the research reported in the literature:

(1) Is there a relationship between the degree of creative behavior of individuals and such measures as tests of cognitive functioning, personality tests, biographical data analyses, and other nonintellectual instruments?

(2) What are the effects of various factors postulated to be inhibiting to productive thinking? (Among these are studies evaluating the effects of pathological personality syndromes, experimentally induced anxiety, and experimentally induced set.)

(3) What is the relative effectiveness of individuals versus groups in problem-solving?

(4) To what extent can creative behavior be deliberately stimulated?

(5) What are the relationships among creativity, intelligence, and achievement?

Prominent Foci of Research and Development: Research and development at the State University of New York at Buffalo during the first ten years was concerned with pilot experimentation and the development of courses, programs, and methods designed to stimulate creative behavior in students. Experimentation was first conducted in the evening division of the University and, later, in the day division. Constant revision, adaptation, and improvement resulted from new insights gained through each experimental course and program.

After this period of preliminary exploration, an extensive research effort was begun in 1958 to evaluate scientifically the results of these methods and programs. During the past eight years, as new knowledge was gained, intensive development activities paralleled the research efforts.

Research dealt with:

(1) the effects of a semester's program in deliberate creativity-stimulation.

(2) the effects of extended effort in creative problem-solving.

(3) the effectiveness of the specific creative problem-solving principle of deferred judgment.

The principle of deferred judgment calls for deliberate deferment of judgment during idea-finding in order to prevent premature judgment from hampering imagination, judgment being applied after a wide variety of alternatives is listed. This principle is equally applicable to individual idea-finding effort and to creative collaboration by groups. Studies covered the use of this principle both by individuals and groups.

Major findings at SUNY/B were as follows:

(1) The semester program resulted in significant increments on the two measures of quantity of idea-production and on three out of the five measures of the quality of the ideas produced. In general, these increases in creative productivity remained evident in another group of students who were tested from one to four years after taking the course. A significant increment on the California Psychological Inventory Dominance Scale also resulted from the program.

(2) Significantly more good-quality ideas were produced by individuals under deferred-judgment instructions than under concurrent-judgment instructions. (Criteria included uniqueness and usefulness of ideas.) The subjects trained in a creative problem-solving course emphasizing the principle of deferred judgment produced a significantly greater number of good-quality ideas when using the technique than did the untrained students. (The same criteria were employed.)

(3) Groups producing ideas on a problem were more productive of good-quality ideas when adhering to the deferred-judgment principle than when employing the more conventional discussion methods which entail concurrent evaluation of ideas. Groups which adhered to the deferred-judgment principle when generating ideas were likewise more productive of good-quality ideas than the same number of individuals working independently under conventional methods which entail concurrent evaluation of ideas.

(4) Extended effort in idea-production resulted in a greater proportion of good ideas among the later ideas produced.

Summaries of the detailed findings and procedures regarding these studies may be found in A Source Book for Creative Thinking (Parnes and Harding, 1962) and Parnes (1963).

The new knowledge derived at SUNY/B and elsewhere has been incorporated into its developmental activities. Annual Institutes have been held for the past twelve years at the University for the study of research and developments in education, industry, government, and national defense. The knowledge resulting therefrom has been integrated each year within new programs at the University. The Thirteenth Annual Institute is scheduled for June, 1967. About 400 will participate in this five-day program.

Experimental instructor's manuals and workbooks have been developed and constantly revised over the past eight years. Two experimental workshops have been held, one for a group of some 60 history teachers and the other for another group of 40 high school teachers. These workshops were designed to help teachers integrate creativity-development with instruction in subject-matter.

Although there are many investigators and organizations that have made significant contributions to the area of creativity, there are at least five universities (besides SUNY/B) which have made major efforts in this direction over an extended period of time. Perhaps the earliest full-scale project was initiated by J. P. Guilford and his associates at the University of Southern California. Although Guilford's total work is not aimed specifically at creativity, his studies on the aptitudes of high-level personnel and his theory on the "Structure of the Intellect" have had major implications for both research and developmental programs in creativity.

Another highly productive group has been the Department of Art Education at Pennsylvania State University. Initially, this group was headed by Victor Lowenfeld, a pioneer in research on art education and creativity. However, after Lowenfeld's untimely death, Kenneth Beittel assumed leadership and has continued to demonstrate considerable progress. The main concern at his institution has been the matter of criteria and predictors of creative art performance. Nevertheless, this group has also made significant contributions to the development of general creative performance through methods of art education.

Another significant influence has come from the six national conferences on the Identification of Creative Scientific Talent under the direction of Calvin Taylor at the University of Utah. In addition to holding conferences, Taylor and his associates have made major contributions to the body of knowledge concerning the criteria and predictors of creative and scientific talent. They have also conducted workshops for teachers.

The Institute of Personality Assessment and Research at the University of California, under the direction of Donald MacKinnon, has also devoted a considerable amount of effort to creativity research. At this institution, MacKinnon, Barron, Gough, and others have concerned themselves especially with the assessment of the personalities of creative writers, artists, scientists, and architects.

Perhaps the most prolific writer in the area of creativity and education is E. Paul Torrance at the University of Minnesota. Torrance and his associates have developed assessment methods for identifying creative talent at all age-levels, from the elementary grades through graduate school. They have studied methods and conditions which affect creative growth, both in and out of the classroom. Manuals, workbooks, and tape recordings have been developed on the elementary and secondary levels by Torrance and his associates.

Other researchers in the nation have also developed programs and materials in conjunction with their efforts. At the University of Illinois, a program of "inquiry training" has been constructed to help elementary school students to ask insightful questions and thus to discover scientific principles on their own (Suchman, 1960). Drews (1963) at Michigan State University, prepared films and a flexible textbook for secondary-level students. Crutchfield prepared and evaluated a self-instructional program developing creative behavior in children. The results of that evaluative study are referred to in a later section of this report (Olton, 1966).

Synectics programs, involving techniques for creativity-stimulation in groups, have been developed on the adult level (Gordon, 1961). Teachers' workshops were conducted at San Jose State College. These workshop programs included the development of instructional materials emphasizing creativity. Melbourne High School and Webber College (Staake, 1963) in Florida have been experimenting with a variety of approaches to the stimulation of creative behavior. Other recent experimenters included Amran (1966), Brown (1965), Eberle (1965), and Williams (1966). Razik (1965) compiled the most comprehensive bibliography on creativity to date. Among its 4,176 references are scores of studies regarding experimentation in the stimulation of creative behavior.

In addition, many experimental efforts in course-offerings have been made at educational institutions throughout the nation. One index of growth is the fact that, during each of the past several years, the Creative Education Foundation has supplied instructor's manuals to about 1,500 potential teachers of such courses in educational institutions, in industrial organizations, in the military, and in governmental agencies. The Air Force has incorporated creative problem-solving into its ROTC curriculum on some 200 campuses. The United States Army Management School at Fort Belvoir, Virginia, has conducted several three-day creative problem-solving seminars, including one designed primarily for Service School instructors. An instructor's manual for a ten-hour course in military creative problem-solving has been produced by the Management School for use by Service Schools throughout the Army.

In addition to the teaching of creative problem-solving per se, the past few years have seen a widespread integration of creativity principles and procedures with conventional courses. Three outstanding examples of courses which have thus been modified are: the economics course by Jere Clark of Southern Connecticut State College, the physics course developed by Myron

Allen of Technical Service Research in Los Gatos, California, and the marketing course conducted by Harry Hansen of Harvard University. The United States Army Management School provides a notable example of the formal integration of the creative problem-solving method within the "case" approach. The known examples of integration of creativity-development include 195 different subjects (Osborn, 1965).

The value of such course-modification has been further indicated by the research regarding the effectiveness of similar integration of creativity principles and procedures with conventionally-taught courses in language arts. As a result of this creativity-orientation, Torrance (1962) found a significant gain in the creative writing ability of the students attending this course. Also, a study by Sommers (1961) reports his discovery that mastery of subject-matter increased, as did creative ability scores, as a result of a similarly integrated course.

EFFECT OF PROGRAMMING ON CREATIVE DEVELOPMENT. Research suggests that incremental teaching of subject-matter can be more efficient than conventional teaching methods. For example, the findings of Galanter (1959) showed that students could master a programmed course in spelling four times faster than a conventionally-taught course. The first comprehensive source book on programmed learning reported a number of pilot research projects which indicate an increase in teaching efficiency (Lumsdaine and Glaser, 1960). Schramm's (1964) annotated bibliography cites 36 studies, of which 17 showed significant superiority for students who completed programs as compared with those in conventional classes. In all but one of the remaining 19 studies, no significant differences appeared. In the one exception, the classroom students proved superior to the programmed ones.

As a result of the encouragement of research, auto-instructional programs are appearing at a rapid rate in practically every academic field. Inasmuch as the effective programming of a textbook is a costly and time-consuming process, many forward-looking educators are asking themselves whether they should reconsider the entire curriculum before developing programs. This would enable them to incorporate the benefits of any improvements into the new programs from the start. By the same token, it seems opportune and appropriate to seek ways of programming the much-sought creative development of students and ultimately, in later stages, to attempt to incorporate this into the newly emerging auto-instructional materials in all fields. Thus an opportunity may be provided to plan for the creative development of students through the new programs.

Many auto-instructional authorities are concerned about development of creative behavior. Kendler of New York University has stated, "We are faced with a serious threat to our national scientific creativity," and claims this is because our language habits are becoming less abstract, more concrete, and more standardized (Galanter, 1959). Stone, of the Department of Health, Education and Welfare, has voiced a common concern of many educators in his statement: "There is a need for more research in the effects of the new media on creativity and on higher thought processes" (HEW, 1961).

Can Creative Behavior Be Programmed? Many psychologists who conduct research in teaching machine programming think that this can be done. Skinner (1961) has written that "teaching machines are by no means confined to imparting explicit repertoires of behavior." That is, programmed learning can require the student to produce more than one "right" or appropriate answer. Klaus of the American Institute of Research writes: "The third level of instruction involves the teaching of such capabilities as creative thinking and judgment. This last level of education may be the area in which auto-instruction will yield its greatest fruits. The possibilities of developing a program in this area are derived from two simple observations. First, we have sufficient data to indicate that creativity and judgment are examples of learned behavior. Second, we have evidence to indicate that these behaviors can be taught. What is left is simply a matter of mechanics: that is, identifying exactly those behaviors to be learned and then finding the means to successfully establish these behaviors in the student's repertoire with auto-instructional methods and devices" (Klaus and Lumsdaine, 1960).

Other psychologists provide further emphasis. Guilford (1961) wrote, "It has seemed to me that it should be possible to introduce training for creative performance by means of modified programs for the machines." Maltzman et al. (1958) have already found that reinforcement can strengthen originality. Cowen (1952) discovered that reinforcement by praise resulted in less rigidity in problem-solving. Carl Rogers (1965) told a symposium that, although programs are well suited for shaping people to "fit" into society, they can also be used to release creative potential.

RESEARCH ON PROGRAMMING FOR CREATIVE DEVELOPMENT. Authorities emphasize the value of creative thinking in programming, but give much less attention to programming deliberately for creative development. Very little of the teaching machine research reported in the literature deals with creative thinking. Barlow (1960) conducted a project in which students were presented alternatives, neither of which was correct. By allowing the students to discover this, and then having them develop a third correct form, he hoped to teach them to think for themselves. Klaus (1961) has been developing programs for teaching independent thinking and judgment, as well as creative writing. Day (1961) has begun a study on thinking and problem-solving. Crutchfield initiated a project on auto-instructional methods and creative thinking for fifth and sixth graders under a grant from the Carnegie Corporation. He obtained strong positive results which are summarized by his associate, Olton (1966), as follows: ". . . in general, children who went through the program scored more than twice as high on the post-test as the control children . . . This very large difference existed over a broad range of creative thinking skills; . . ."

IMPLICATIONS FOR BASIC RESEARCH. Auto-instructional research is usually aimed at ascertaining factors in learning efficiency and determining to what degree each factor or variable can be varied, alone or in combination, in order to develop optimum efficiency in learning. Some variables are functions of the machines, some are functions of the program, some are functions of the students or their environment, and some are functions of all four.

Such learning variables are also creative variables; i.e., the more we learn, the more ideas our imaginations have to manipulate. This does not mean, however, that factors which effect learning will necessarily have the same relative effect on creative behavior and vice versa. It seems obvious, however, that while certain aspects are stressed more in creative behavior than in learning and vice versa, the optimum situation would be a happy balance between the two.

It follows that research regarding creative behavior should closely accompany auto-instructional research. Any future research which reveals that a certain procedure has impact upon learning effectiveness should be checked to ascertain whether it is also helpful or detrimental to creative development. This, of course, opens up new fields of basic research in creative behavior. For instance, if reading speed, eyespan, speed-of-association, and other such factors increase retention and comprehension, this does not necessarily mean that they also enhance creative development. When one considers the part played by incubation in creative thinking, one realizes that the variable "time" may bear so complex a relationship to creative thinking that much research will be needed on this point. Incidentally, research has already indicated that "uncommonness and remoteness of response" increase with time, while "cleverness" has been found to be independent of time (Christensen et al., 1957).

II. OBJECTIVES OF THE RESEARCH

General Objective. The hypothesis tested was that scores on creative ability tests can be significantly increased through a program developed to present incrementally the principles and procedures of a creative problem-solving course. As a by-product, the effect of such a program on student attitudes toward the course was also studied.

Specific Objectives.

(1) To reduce various creative abilities--fluency, flexibility, originality, elaboration, and sensitivity--to their manifestations in defining and solving problems creatively. That is, using the principles and procedures of a creative problem-solving course, creative abilities were reduced to actual behavior which manifests these traits and abilities. In behavioristic terms, fluency is defined as the ability to generate many responses (ideas) in response to one discriminative stimulus (problem). Flexibility is defined as the ability to generate many different classes of responses (ideas) in response to one discriminative stimulus (problem). Originality is defined as the ability to create a response that is statistically uncommon. Elaboration is defined as the ability to generate many responses (details) that implement or spell out an idea which serves as the discriminative stimulus. Sensitivity is defined as the ability to generate many problems or challenges as responses to a situation or observation that serves as the discriminative stimulus.

(2) To devise means of immediately reinforcing any response showing any slight tendency towards such creative behavior. Such reinforcement was constructed so that it was not limited to only one correct response. Rather, reinforcement was provided for any response that was considered acceptable and met criterion standards.

(3) To conduct error-analyses and revise the program as necessary for optimum effectiveness.

(4) To ascertain, by using experimental and control groups in a pretesting and post-testing design, to what degree this "optimum" program increases the students' creative behavior as measured by various creative ability tests. The purpose of the control groups is to provide a base line for differentiating between improvement due to the treatment effects and that due to general growth and practice effect.

(5) To determine, by the use of experimental and control subjects.

whether or not subjects receiving creative problem-solving training by programmed methods alone show increases in creative ability to the same extent as do subjects receiving the same error-free programmed materials by instructor-taught methods, and whether or not either or both of these groups show a significant gain in creative ability when compared with control subjects receiving no training.

(6) To study the attitudes toward the course of students taking the programmed version alone as compared with those receiving the programmed material via an instructor.

III. PROCEDURE

A Chronological Outline of the Development and Evaluation of the Programmed Materials

Fall, 1963

Completion of first set of five pilot programmed-booklets on the following phases of the creative process: Orientation (two booklets), Observation, Manipulation, and Evaluation.

A. Experimentation and error-analysis of the above with three groups:

1. Fifty day and evening students of creative problem-solving courses at State University at Buffalo;

2. Fifteen engineers and other personnel in a value engineering course at Sylvania Electronic Systems;

3. A volunteer Creativity Programming Committee made up of about ten faculty of SUNY/B and several evening instructors from education and industry.

Spring, 1964

A. Pilot testing of above at Sylvania, using Guilford creativity tests on experimental and control groups. The control group received comparable training from an instructor of creative problem-solving of Sylvania's central staff. Although proper sampling and experimental controls were lacking, and although rigorous statistical tests were not computed, results did indicate that the post-test scores of students taking the program were approximately equivalent to those of students who had instructor-training. There was even some indication of greater originality and sensitivity on the part of the program-students.

B. First and second major revisions of Observation and Evaluation booklets, based on all error-analysis and feedback mentioned above.

Summer, 1964

A. Experimentation and error-analysis on Observation and Evaluation booklets with 250 new enrollees in Tenth Annual Creative Problem-Solving Institute, June of 1964, plus 150 faculty and leaders at same Institute.

B. Analysis and critique of above by consultants during and after above Institute, as well as by special group of leaders at the Institute.

Reactions were most encouraging with respect to participants' attitudes toward the program. These experimental materials were introduced in place of the skilled and enthusiastic instructors who would otherwise have conducted the particular sessions. In spite of this, and in spite of the fact that the participants had not expected to be given any programmed materials, 87 per cent found the experience from "acceptable" to "highly enjoyable"; only 13 per cent found it "distasteful" or "very distasteful."

As to the effectiveness of the programmed instruction, 52 per cent of the participants felt it was "capable" or "superb," 33 per cent "passible," and 15 per cent "poor" or "terrible." Significant improvements were made in the newer versions, based on the reactions and recommendations. Of course, the comments herein refer to participants' reactions only, rather than to measured effectiveness in improving creative ability. However, the experimenters were much concerned with participants' attitudes because of the widespread feeling among creative problem-solving instructors that "you cannot program creative behavior."

C. Experimentation and error-analysis on Observation booklet with fifty students in psychology class at Cornell University. (Half were administered Revision 1, half Revision 2.)

Results: As to student preference, results were inconclusive. Each version received comparable feedback in terms of preference of those who took it at Cornell. (The same was true at the Institute.) However, based on a post-test on a creative task given to the Cornell students, the first experimental version appeared more effective. Hence, the decision was made to follow that style of programming for the present research.

D. Experimentation with Observation booklet with a group of 22 supervisors at Headquarters, U. S. Army Tank-Automotive Center, Warren, Michigan.

Fall, 1964

Third major revision of Observation and Evaluation booklets, based on error-analyses and feedback from 400 Institute members and 50 Cornell students. First major revision of Orientation and Manipulation booklets; construction of remaining booklets.

A. Construction of five consecutive Observation booklets and two consecutive Evaluation booklets.

B. Revamping of Manipulation booklet into six consecutive booklets, based on experiences with Observation booklets.

C. Reconstruction of two Orientation booklets into series of six booklets, based on (1) error-analyses described under Fall, 1963, on page 17, (2) experience with other booklets, and (3) feedback from about two dozen individuals.

D. Construction of remaining booklets to make a total of 30.

E. Experimentation and error-analysis with 25 students (SUNY/B day students in a creative problem-solving course).

F. Feedback from the students. This confirmed the need for the resequencing of the course.

Spring, 1965

Major revision and resequencing of entire 30 booklets, based on student reactions and error-analysis mentioned in E above.

A. Error-analyses of all 30 booklets on three new groups: (1) three paid college-students, (2) 15 SUNY/B day students in a creative problem-solving course, (3) 20 college-bound high school seniors at one of Buffalo's city high schools.

B. Editing and revising of booklets by staff and eight consultants, in preparation for testing of the experimental hypotheses. Special attention was paid to necessary changes in timing so as to allow the slower students to complete the basic material in a single class period, yet to provide enough supplementary exercises to challenge the faster ones for the entire period. The booklets were thus designed so that each student could "stretch" his imagination for a full 40 minutes on each one. This is important because the course is concerned with relative gains of each individual. There are no absolute standards against which he is measured.

Summer, 1965

Preparation for major experimental evaluation of finished booklets.

A. Restructuring of 30 booklets into 26 course sessions. Some booklets were combined as a result of the last error-analyses. The final set includes 28 booklets for the 26 sessions. (Two booklets each--a Part A and a Part B--are designed for two particular sessions--thus 28 booklets instead of 26.)

B. Printing and preparation of the final booklets.

Fall, 1965

A. Setting up matched experimental and control groups from 1,086 volunteers for the final experiment. Six academic high schools in the Buffalo Public Schools were included in the major experiment; the remaining two academic high schools were used for additional pilot-experimentation.

B. Conducting pre-testing, experimental courses, and post-testing.

C. Computing reliability of scorers.

D. Scoring of tests.

E. Revision of booklets into two additional forms: (1) a "long-form," which provides all "convergent" responses but leaves blanks for all "divergent" responses; (2) a "no-response" form, which leaves blanks for all responses as did the original set, but which does not provide the printed response as reinforcement.

F. Preparations for the control students of the present experiment to take the course in the spring as they had been promised. The different types of program-format (described in E above) were then available for pilot-experimentation in the spring classes. Thus preliminary evaluations will be possible of the relative effectiveness and student-preferences of different booklet-formats, as well as of different modes of instructor-involvement with the presentation of the materials.

G. Completion of another error-analysis, on the booklets used by the experimental students. Even though all of the booklets had been thoroughly error-analyzed before, minor modifications were suggested by the feedback from the large group of students who took the programs. All of these changes were incorporated into the revised copies prepared for the spring classes.

H. Preparation of a final questionnaire to obtain thorough feedback on student reactions. Session-by-session feedback had also been obtained through brief questionnaires in each of the booklets.

Spring, 1966

A. Analysis of results of major experiment.

B. Pilot-experimentation in all eight schools with respect to the three types of booklets and with respect to different modes of teacher-involvement in the learning process.

IV. THE EXPERIMENTAL METHOD

THE GROUPS:

Control	Program Alone	Program Instructor-Presented[1]
62 subjects	62 subjects	62 subjects

These three groups (randomly selected from 1,086 who requested to be included in the experiment[2]) were matched on the basis of the Lorge-Thorndike I. Q. Students eligible for the experiment were seniors who intended to continue their formal education after graduation. The majority of those eligible volunteered for the experiment. All were students in the eight academic high schools of the Buffalo Public Schools.

In order to increase the accuracy of the matching and to insure an adequate number of subjects for each group, as well as to provide the additional "in-school" control groups explained later in the report, the initial number of subjects that was selected and tested was 335. Students with ten or more absences per semester in the previous year were excluded as poor risks, except in a few cases where subjects with one or two extra absences were needed for better matching of groups.

Took course in spring of 1966[3]	Took course in fall of 1965[3]	Took course in fall of 1965[3]
Tested at beginning and end of fall, 1965; i.e., both pre- and post-tests given before taking course.	Tested at beginning and end of fall, 1965.	Tested at beginning and end of fall, 1965.

PRE-TESTING: One week--two full periods--was used for the battery of 11 psychological pre-tests for all three groups.

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[1] Instructors presented in conventional fashion exactly the same material as in the incremental program, with no deviations being allowed. This worked a hardship on instructors, but made possible a more controlled experimental comparison. Students had the opportunity to interact on all divergent responses rather than merely to write their ideas as did those taking the program alone.

[2] The manner in which volunteers were obtained is described in Appendix D.

[3] One quarter unit of high-school credit was given.

All testing was divorced from instructing; i.e., the instructor or program-proctor for an experimental section never tested his own class. Each tester introduced the pre-tests with the following instructions:

> I am ______________________ of the staff of the Creative Education Office. This is "blast-off" hour for the very significant experiment of which you are now an important part.
>
> As was explained to you in the earlier material you read, the tests you will now take will have nothing to do with your grades or school records. They will not be shown to your teachers or administrators. However, they are an important part of the research project in which you are participating.
>
> I think you will find interesting what you are asked to do. Sometimes the nature of the task may seem strange or silly. Nevertheless, please cooperate to the fullest extent inasmuch as everything you are asked to do is highly significant. Do the very best you can on each test.

Before the second period of pre-testing, the following instructions were read:

> These tests, like the last ones, will not be used other than for research purposes. No individual scores or papers will be shown to anyone other than the University research staff, who will be identifying your papers by a number rather than a name.
>
> This second set of tests are as vitally important as those you took earlier. Again you may find some parts of the test unusual or strange; but please cooperate fully inasmuch as everything you are asked to do is highly significant. Do your very best on each test.

TREATMENT:

Control	Program Alone	Program Instructor-Presented
None	13 weeks--two periods per week--for course. Students were assigned to classes, in their own high schools, during their study periods. Each class met twice a week during the entire semester. There was no required outside work. See Appendix F for further information re the course content.	

POST-TESTING: One week--two full periods--was used for the battery of 11 psychological post-tests for all three groups.

The schedule of testing was so arranged that for each section, the same tester who conducted the pre-testing was assigned to carry out the post-testing.

Before the post-tests, these instructions were given:

> Please print your name and homeroom number on the outside flap of the envelope. Do not put your name on any test paper. I was with you a semester ago for "blast-off" on the very significant experiment of which you are a part. We might call the testing you will now undergo the crucial "recovery" phase of this experiment.
>
> As explained earlier, the tests you will now take will have nothing to do with your grades or school records. They will not be shown to your teachers or administrators. However, they are an important part of the research project in which you are participating.
>
> All of you are subjects in an experiment designed to measure changes which may have occurred in your thinking as a result of all your course work this semester.
>
> During today's period you will be given the post-test, consisting of a series of tests similar to the ones given the first time.
>
> It is crucial to discover whether those who haven't yet taken the creative thinking course can increase their scores on these tests as much as or more than those who did take the training last term. Otherwise, we will never know how effective the course actually is, and how worthwhile it is to offer it to students in high school generally. Therefore, you are providing data as important to the future of education as the astronauts' data was to the future of space exploration.
>
> If you would like to have a summary of the general results of this experiment when it becomes available, put your home address on the envelope of tests. Individual test results will not be included in the summary--only conclusions based on group averages.
>
> I think you will find interesting what you are asked to do. Sometimes the nature of the task may seem strange or silly. Nevertheless, please cooperate to the fullest extent inasmuch as everything you are asked to do is highly significant. Do the very best you can on each test.
>
> In the tests you will now take, you may use any appropriate answers which you may have used before and/or any new answers. The important point is to get as high a score as possible on the present test.
>
> Be sure you have ready a pen or pencil and your test envelope only. No other notes or materials may be used during these final tests.

The second period of post-testing was introduced as follows:

> These tests, like the last ones, will not be used other than for research purposes. No individual scores or papers will be shown to anyone other than the University research staff, who will be identifying your papers by a number rather than a name.
>
> This second set of tests are as vitally important as those you took earlier. Again you may find some parts of the test unusual or strange; but please cooperate fully inasmuch as everything you are asked to do is highly significant. Do your very best on each test.

POST-TESTING (continued):

Control	Program Alone	Program Instructor-Presented
Tests determined to what extent creative behavior increased without any training in creative problem-solving.	Tests determined degree to which the creative behavior increased due to training in which the students used only the programmed books.	Tests determined degree to which the creative behavior increased due to training in which the students were taught by instructors who presented the materials in the programmed books.

Both these groups were given an extensive questionnaire at the end of the course to assess their attitudes toward the experience.

SCHOOL TYPES:

Control		Program Alone		Program Instructor-Presented	
School #1	School #2	School #3	School #4	School #5	School #6
Type I	Type II	Type I	Type II	Type I	Type II
31 students	31 students	31 students	31 students	31 students	31 students

Schools were assigned to Type I or Type II as a result of ratings by a panel of three professional members of the experimental staff. Schools were rated on the extent to which both the school and the neighborhood show an academic emphasis and an interest in education as a whole, including cultural and enrichment opportunities. Type II schools were rated higher in this regard than Type I schools. Within each type, the schools were randomly assigned to the three different treatments.

Type I schools were very similar to one another. However, the Type II schools were less homogeneous. Hence the comparisons among Type I schools are more valid. However, there was only one test among the 11 in which there proved to be a consistent effect of school type on treatment means. Therefore, the Type II data are, in effect, a replication of the Type I data.

IN-SCHOOL CONTROLS:

Six different schools[1] were used to prevent contamination, i.e., to eliminate discussion between groups, and to minimize possible replication error. However, additional "in-school" control groups were also used for comparison purposes. Since there turned out to be no evidence of contamination, the results to be reported include these "within-school" comparisons.

Thus, in addition to the control students mentioned above in the two separate "control" schools, the "in-school" control groups served as a "double-check" in the experiment. The fact that, as will be shown later, both the "outside-school controls" and the "in-school controls" gained, in general, significantly less than did the experimental (trained) students, increases the confidence that may be placed in the results of the experiment. This is especially reassuring inasmuch as the experimental subjects in a particular school are even more certain to be equally matched with "in-the-same-school" controls than with their control subjects in other schools.

SCORING:

All measures were scored by two independent raters. Protocols were coded so that no rater was aware of what type of subject or school he was rating.

Pearson correlation coefficients between the scores of these raters were computed for all ability measures. Computations were based on a randomly selected sample of 50 subjects, after each rater had done an initial group of 50. In post-tests, whenever alternate forms were used and the raters were already trained and experienced, a random sample of 35 protocols was used for computation of reliability. Correlations are shown on the next page.

All test measures were scored in accordance with standard scoring instructions provided by the various authors of the tests.

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[1] Six schools are needed for the type of experimental design used. However, all eight academic high schools were used so as to provide equivalent opportunity to all college-bound students. The data from the extra two schools are being used for additional studies. Likewise, the data provided in the spring (as a result of the course offerings then to all control subjects) will be used for further studies regarding a variety of methods of presenting the course.

Reliability of Scoring

Test	
Associational Fluency	.94
Other Uses-Quantity	.99
Consequences-Total	.97
Product Improvement-Toy Dog-Fluency	1.00
Product Improvement-Toy Monkey-Fluency	1.00
Alternate Uses	.96
Product Improvement-Toy Dog-Flexibility	.82
Product Improvement-Toy Monkey-Flexibility	.74
Consequences-Remote	.68
Product Improvement-Toy Dog-Originality	.78
Product Improvement-Toy Monkey-Originality	.81
Planning Elaboration-Part A	.88
Planning Elaboration-Part B	.99
Apparatus-Items 1-9	.80
Apparatus-Items 10-18	.78

Guilford Measures. In order to allow for a wider range of testing, abbreviated forms of four of the Guilford tests were used. The experimenters were informed by J. P. Guilford's offices that the reliability of the tests was not seriously impaired by shortening them as follows:

Apparatus -- Items 1-9 for pre-test, 10-18 for post-test
Planning Elaboration -- Part A for pre-test, Part B for post-test
Alternate Uses -- Part I and II only (same for pre and post)
Consequences[1] -- Items 1-3 only (same for pre and post)

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[1] In Guilford's Consequences test the total score was used for fluency instead of the obvious score. This was done for the following reason: After creativity training, subjects tend to give relatively more of the "remote" responses (originality) and relatively fewer of the "obvious" ones (fluency). Therefore, if fluency of ideas were computed by counting only the number of "obvious" ones, it would appear that a subject's fluency decreases as a result of training. When summing the two scores, however, the total score almost invariably increases. For example, suppose a subject gave two obvious ideas and five remote ones in his pre-test (total - 7), but gave one obvious idea and ten remote ones in the post-test (total - 11). In Guilford's scoring system the subject would have increased in originality but decreased in fluency. In relation to other types of fluency tests, however, he has increased his fluency as well as his originality; for other tests used to measure fluency in the experiment derive these fluency scores from the totals.

In conversations with the investigator, Guilford recommended caution in interpreting the "total" score (on his factor-analyzed test) as a pure fluency score, inasmuch as there is the strong impact of the originality factor being reflected in the total. The Consequences Total as a fluency measure, however, seems to provide essentially the same results in the present experiment as do the other fluency tests.

It had been intended to use items 6-8 of the Consequences test for the post-testing. However, because of the difficulty of obtaining a sufficiently high interrater-reliability in the pre-tests, it was decided to repeat the same three items with which the raters were already familiar.

The fifth Guilford test, Associational Fluency, was used in its complete form, since the experimenters were informed that shortening this particular test does cut down considerably on reliability.

The Product Improvement Test[1] (Torrance, 1962) was given last in the battery. The Toy Dog form was used for pre-tests, with the Toy Monkey being given as the alternate post-test form. A five-minute time limit was given in the pre-tests. For the post-tests, students were again told they would have five-minutes time. However, when the five minutes were up, they were then told to draw a line under the last idea listed, and to continue for another five minutes. Then, at the end of the second five minutes, they were told to draw a line again and to continue for a final two minutes. Thus the original five minutes of data was available for analysis as comparable post-test data. The data from the additional five-minute and two-minute periods of the post-test are available for further analysis, and will be studied later with respect to "extended effort" effects. This will follow up earlier studies of this nature (Parnes, 1961).

AC Test of Creative Ability. Only one item from Part V of the AC Test was employed because of the time limitation (listing all possible uses for a wire coat hanger). This item only had been used in several previous studies (Meadow and Parnes, 1959; Parnes and Meadow, 1959; Meadow, Parnes and Reese, 1959: Parnes and Meadow, 1960; Parnes, 1961).

California Psychological Inventory. The CPI Dominance Scale was scored according to standard instructions provided by Gough[2] (1957).

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[1] The Product Improvement test can be scored for fluency, flexibility, originality and elaboration. Because of the lengthy scoring-time involved, it had been intended to rate the protocols only on the first two measures. It became possible, however, to complete scoring on "originality" as well. It is intended to score the tests later on "elaboration" and to analyze the additional data thus derived.

[2] We wish to thank Harrison Gough for providing the individual-item key for the scale used. We also wish to express acknowledgement to the Consulting Psychologists Press, Inc., Palo Alto, California, for permission to use the scale.

Intercorrelations among the Pre-Test Scores on the various tests and among the Pre-Test to Post-Test Gain Scores are given in Tables 1 to 6 in Appendix I. Correlations of these scores with IQ and sex of subjects are also given. In general, neither IQ nor sex was importantly correlated with the test scores.

V. FINDINGS

The results of the tests will be summarized in Part A, and then presented with detailed statistical analyses in Part B. Part C will present an analysis of student reactions.

A. SUMMARY

The experimental students, on almost every test, made greater gains than did the control students. In almost all of the measures, the gains of the instructor-taught programmed-groups were significantly superior to that of both control groups. In the case of the groups who took the program alone, the students were significantly superior to the control students in gains on most tests, but not to as large a degree. In other words, the instructor-taught groups tended to be more markedly and consistently superior to the control groups than did the students who had the program without an instructor.

Qualities of Creative Behavior Measured

Fluency	Flexibility	Originality	Elaboration	Sensitivity
ability to generate many similar ideas: i.e., in thinking up uses for a paper clip, examples are: clip money together, clip tie to shirt, clip name-plate to pocket.	ability to generate ideas outside of usual category and in many categories: i.e., in thinking up uses for a paper clip, examples are: connect dry-cell batteries, clean pipe, shoot from rubber band, etc.	ability to generate statistically-uncommon responses: i.e., in paper clip uses, an example is: a race track for fleas.	ability to implement or spell out ideas; i.e., in paper clip uses, an example is: use as a tie clasp, gold plate it, add wire initials and sell for $2.98.	ability to sense problems; i.e., in thinking of improvements for a paper clip, an example is to rubberize the wire to give it a firmer grip (sensitivity to the problem of papers slipping out of their paper clips).

The most clear-cut effects of the training were on Flexibility and Elaboration.

Instructor-taught ≥ Program-Alone > both Controls.

Fluency Flexibility Originality Elaboration Sensitivity

The next most clear-cut effects of the training were on Fluency and Originality.

Instructor-taught ≥ Program-Alone ≥ both Controls.

Another test of originality, mentioned earlier, has not yet been statistically analyzed. This is the test concerning the effects of extended effort upon originality. From a preliminary analysis of the data on this additional test, the effects appear to be even more strongly in favor of all experimental students than were the effects of the originality tests summarized above.

The least clear-cut effect of the training was on Sensitivity.

Instructor-taught = Program-Alone ≥ both Controls.

The ability to think of improvements for common objects was illustrated earlier as a measure of sensitivity. "Improvement" exercises were used constantly throughout the course (different ones, naturally, from the items in the test). It is surprising to the investigators that this "sensitivity" gain was the smallest. From examining the results of periodic exercises throughout the course, it is apparent that the experimental subjects should have been able to to much better than they did on this test. As a matter of fact, in the students' questionnaires, almost half of them reported perceived gains in sensitivity at the high end of the scale. Inasmuch as students had complained frequently during the course about the repeated emphasis on improving common objects, it may be that they were poorly motivated for that particular test. Further study is thus indicated on this factor.

One personality factor was measured, in addition to the abilities discussed above. This was the "dominance" trait, on which increases had been reported in an earlier investigation with older subjects in day and evening college classes (Meadow and Parnes, 1959). No changes were observed on this measure in any of the experimental or control groups.

In general, results were similar for both types of schools studied. The school-type made a consistent difference on gains on only one test--Associational Fluency--a test of the ability to list words that bear some relation to a given word. In this test, results were ambiguous. Where there were any differences, these differences were always in favor of the experimental students. However, in some comparisons there was no difference between experimental and control students on this test.

B. DETAILED STATISTICAL ANALYSES OF DATA

The pre-test data were analyzed in order to ascertain whether the School Types differed initially, whether the schools within each Type differed initially, and whether the groups within each Experimental school differed initially. (It might be noted that the third kind of difference would represent sampling error, since the subjects were assigned to the Experimental and In-the-Same-School Control groups in a random manner.) The logic of the experiment required the use of three separate analyses, each with a two-by-three factorial design. In each analysis the factors were School Types, with two levels, and Groups, with three levels. In "Run A" the Program-Alone, With-Instructor, and Control School groups were compared; in "Run B" the Program-Alone, Program-School Control, and Control School groups were compared; and in "Run C" the With-Instructor, Instructor-School Control, and Control School groups were compared. (The Program-School Control groups were in the same schools as the Program-Alone groups; and the Instructor-School Control groups were in the same schools as the With-Instructor groups.) School Types I and II were represented in all three analyses. Each "run" tested differences between School Types and differences among schools within Types. Runs B and C also tested differences between groups within schools (e.g., Program-Alone group versus Program-School Control group).

Table 1 gives the cell frequencies (group sizes) for the analyses of variance and covariance, and shows how 31 subjects were obtained in each of the major groups. The analyses of variance and covariance require equal numbers of subjects in corresponding groups in the two School Types. The

Table 1

Sample Sizes for Analyses of Variance and Covariance

	Type I Schools					Type II Schools				
Sample Size	Prog. - Alone	Prog. - School Control	With- Inst.	Inst. - School Control	Control School	Prog. - Alone	Prog. - School Control	With- Inst.	Inst. - School Control	Control School
All tests except Other Uses	31	10	31[a]	12	31	31	10	31	12	31
Other Uses	31	10	17	12	27[b]	31	10	17[b]	12[b]	27
Number of Omitted Subjects										
All tests except Other Uses	0	1	a	0	1	0	0	2	12	0
Other Uses	0	1	13	0	0	0	0	0	0	4

[a] Includes one fictitious subject (group means). (See Lindquist, 1956, p. 148.)
[b] Data lost because of expiration of available testing time (Other Uses was last test in battery).

numbers of available subjects were examined, and the numbers to be omitted were determined in such a way that the numbers retained were maximized within the imposed restriction. Insofar as possible, subjects to be omitted were selected on the basis of some kind of "contamination," such as having an excessive number of absences from school, having an Otis IQ score instead of a Lorge-Thorndike IQ score, or having taken the tests in an unusual way--for example, because of being absent on the scheduled testing day. (In no cases were test data examined in making the selection.) When necessary, additional subjects were omitted by selection from a table of random numbers.

Table 2 presents the mean pre-test scores of the various groups, and Table 3 summarizes the analyses of variance of the pre-test data. As can be seen in Table 3, the School Types by Groups interaction was statistically significant in almost every "run." The interactions indicate that there were differences among schools within each School Type, and that the directions of difference were not the same in both School Types. The differences were fairly large, as can be seen by inspection of Table 2.

Because the magnitudes of the differences among the groups on the pre-tests were fairly large, the post-test data were analyzed by means of analysis of covariance techniques. Three runs were used, with the same comparisons as in the three pre-test runs. The means of the adjusted post-test scores are presented in Table 4. (The means of the raw post-test scores and the means of the adjusted post-test scores from each separate run are given in Tables 7 and 8 in Appendix I.) In general, the With-Instructor groups had higher adjusted post-test means than the Program-Alone groups and both control groups (i.e., the Instructor-School Control and Control School groups). With somewhat less consistency, the Program-Alone groups were superior to the corresponding control groups (i.e., the Program-School Control and Control School groups).

The results of the analyses of covariance are summarized in Table 5. The Run A analyses, comparing the Program-Alone, With-Instructor, and Control School groups, indicated that the main effect of Groups was significant on every test of creativity but was not significant on the personality test (C. P. I. Dominance). The School Types by Groups interaction was not significant except in the three runs on Associational Fluency and in Run C on Other Uses.

Tables 6 and 7 summarize the results of _t_ tests comparing individual

Table 2

Pre-test Means

Test	Type I Schools					Type II Schools				
	Prog. - Alone	Prog. - School Control	With- Inst.	Inst. - School Control	Control School	Prog. - Alone	Prog. - School Control	With- Inst.	Inst. - School Control	Control School
Assoc. Fluency	12.1	13.0	11.6	10.9	13.4	14.0	15.0	13.4	13.5	11.8
Other Uses	8.0	8.1	7.6	6.2	9.3	9.0	10.4	9.9	7.8	8.5
Conseq. Total	15.6	16.3	13.0	15.4	15.8	16.5	15.7	17.4	14.6	13.6
P.I. Fluency	11.3	11.7	10.6	11.3	12.9	13.6	11.2	13.6	12.8	10.1
Alt. Uses	13.4	15.0	14.4	14.6	15.7	17.0	16.8	16.3	14.1	14.3
P.I. Flexibility	6.6	5.9	5.8	6.8	6.7	6.6	6.6	7.0	6.5	5.8
Conseq. Remote	5.7	4.3	5.0	5.6	6.3	6.6	5.7	7.2	6.9	4.3
P.I. Originality	9.3	10.6	8.4	9.2	10.8	11.9	10.1	11.5	10.3	8.2
Planning Elab.	10.2	11.0	8.9	9.8	10.5	10.4	10.8	11.7	12.7	9.9
Apparatus	6.4	7.3	6.9	5.7	7.4	7.1	5.9	8.6	7.2	5.7
C.P.I. Dominance	27.4	25.2	26.9	22.0	24.1	26.9	27.6	27.6	28.9	26.2
IQ	116.4	114.8	113.6	114.8	116.7	118.2	120.6	118.8	117.2	117.1

Table 3

Pre-test -- Results of Analyses of Variance

		Test											
Source of Variance	df	Assoc. Flu.	Other Uses	Conseq. Total	P.I. Flu.	Alt. Uses	P.I. Flex.	Conseq. Remote	P.I. Orig.	Plan. Elab.	App.	C.P.I. Dom.	IQ
Run A													
Schools (S)	1	1.32	2.10	2.01	2.03	3.75	<1.00	<1.00	2.44	2.87	<1.00	<1.00	5.30**
Groups (G)	2	<1.00	<1.00	1.20	<1.00	<1.00	<1.00	1.47	<1.00	<1.00	4.83***	2.19	<1.00
S x G	2	3.40*	1.82	6.96***	10.34***	4.58**	6.37***	6.75***	7.99***	4.79***	8.97***	<1.00	1.74
within cells	-	17.27 (179)	10.30 (144)	24.63 (179)	14.90 (179)	22.41 (179)	2.45 (179)	10.35 (179)	18.85 (179)	10.25 (179)	5.26 (179)	40.34 (179)	53.70 (179)
Run B													
Schools	1	<1.00	1.31	<1.00	<1.00	2.08	<1.00	<1.00	<1.00	<1.00	2.53	<1.00	2.35
Groups	2	<1.00	<1.00	1.11	1.03	<1.00	<1.00	1.54	1.14	<1.00	<1.00	1.41	<1.00
S x G	2	2.94	1.52	1.29	6.71***	4.17**	2.43	3.61*	6.32***	<1.00	4.40**	<1.00	1.15
within cells	-	17.61 (138)	9.93 (130)	29.33 (138)	14.63 (138)	24.12 (138)	2.28 (138)	10.77 (138)	16.62 (138)	10.70 (138)	5.55 (138)	44.33 (138)	47.71 (138)
Run C													
Schools	1	<1.00	1.96	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	6.43**	<1.00	5.04*	5.40**
Groups	2	<1.00	4.06**	<1.00	<1.00	<1.00	<1.00	1.41	<1.00	<1.00	5.30***	2.03	<1.00
S x G	2	3.50*	2.12	7.53***	8.91***	1.93	6.53***	7.30***	7.22***	4.63**	9.87***	2.29	1.74
within cells	-	16.77 (141)	9.64 (106)	23.96 (141)	15.23 (141)	22.78 (141)	2.47 (141)	9.71 (141)	16.93 (141)	11.36 (141)	5.16 (141)	37.36 (141)	51.10 (141)

Note: The "within cells" rows give mean squares and in parenthesis *df*.

* $p < .05$
** $p < .025$
*** $p < .01$

Table 4

Average Post-test Means Adjusted for Pre-test Differences (by Covariance)

Test	Type I Schools					Type II Schools				
	Prog.-Alone	Prog.-School Control	With-Inst.	Inst.-School Control	Control School	Prog.-Alone	Prog.-School Control	With-Inst.	Inst.-School Control	Control School
Assoc. Fluency	16.0	12.7	13.3	13.7	14.1	16.3	16.1	16.1	13.0	12.2
Other Uses	12.7	9.4	13.2	8.8	11.3	13.3	9.2	17.3	9.2	11.1
Conseq. Total	17.8	15.6	19.0	14.6	16.1	18.0	18.1	20.9	15.9	15.3
P.I. Fluency	14.6	11.4	17.0	11.9	12.4	14.6	12.8	17.8	12.6	13.6
Alt. Uses	18.9	18.0	19.0	15.9	15.9	20.3	16.6	19.1	16.0	15.7
P.I. Flexibility	7.5	5.9	8.5	6.0	6.9	7.9	6.7	8.7	6.9	6.1
Conseq. Remote	7.2	7.1	8.1	5.7	6.3	7.6	6.5	8.6	7.1	7.1
P.I. Originality	4.8	1.7	4.6	3.0	3.9	4.9	2.3	6.4	4.0	3.1
Planning Elab.	12.8	10.2	14.0	10.2	11.8	13.0	10.8	14.2	11.1	10.6
Apparatus	8.2	7.8	8.5	8.0	7.2	8.4	7.1	8.7	8.3	7.2
C.P.I. Dominance	28.2	27.9	27.7	27.0	26.9	28.1	26.8	27.1	26.2	26.7

Note: Means for Prog.-School Control and Inst.-School Control are from Runs B and C, respectively. The other means are means of adjusted means from Runs A and B (Prog.-Alone), A and C (With-Inst.), or A, B, and C (Control School). Cell frequencies for analyses of covariance same as for analyses of variance of pre-test scores.

Table 5

Post-test -- Results of Analyses of Covariance

Test

Source of Variance	df	Assoc. Flu.	Other Uses	Conseq. Total	P.I. Flu.	Alt. Uses	P.I. Flex.	Conseq. Remote	P.I. Orig.	Plan. Elab.	App.	C.P.I. Dom.
Run A												
Schools (S)	1	<1.00	2.53	<1.00	1.11	<1.00	<1.00	1.32	<1.00	<1.00	<1.00	<1.00
Groups (G)	2	9.07***	10.49***	17.80***	16.23***	14.01***	22.98***	3.69*	6.99***	12.52***	4.00**	1.32
S x G	2	5.73***	2.66	1.75	<1.00	<1.00	2.24	<1.00	2.95	<1.00	<1.00	<1.00
within cells	-	14.85 (178)	16.56 (143)	16.29 (178)	18.98 (178)	18.83 (178)	2.97 (178)	11.51 (178)	9.22 (178)	10.79 (178)	7.06 (178)	19.81 (178)
Run B												
Schools	1	<1.00	<1.00	<1.00	1.05	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Groups	2	8.55***	7.51***	4.35**	3.39*	12.01***	10.24***	<1.00	8.44***	7.14***	3.25*	1.34
S x G	2	3.55*	<1.00	1.35	<1.00	<1.00	2.86	<1.00	<1.00	1.09	<1.00	<1.00
within cells	-	15.61 (137)	15.79 (129)	14.90 (137)	18.91 (137)	18.66 (137)	2.78 (137)	10.69 (137)	8.06 (137)	9.29 (137)	5.87 (137)	15.57 (137)
Run C												
Schools	1	<1.00	3.43	1.11	1.85	<1.00	<1.00	2.09	1.55	<1.00	<1.00	<1.00
Groups	2	3.25*	23.48***	22.14***	21.09***	11.58***	28.55***	5.05***	8.85***	15.80***	3.88**	<1.00
S x G	2	6.82***	4.56**	1.82	<1.00	<1.00	2.99	<1.00	2.76	1.06	<1.00	<1.00
within cells	-	13.05 (140)	12.22 (105)	15.72 (140)	18.24 (140)	16.49 (140)	2.81 (140)	10.83 (140)	8.03 (140)	11.03 (140)	7.23 (140)	19.87 (140)

Note: The "within cells" rows give mean squares and in parenthesis df.

* $p < .05$

** $p < .025$

*** $p < .01$

Table 6

Comparisons of Adjusted Post-test Means (from Analyses of Covariance):
I. Comparisons of Groups in Combined School Types

		Test							
Groups Compared	Run	Conseq. Total	P.I. Flu.	Alt. Uses	P.I. Flex.	Conseq. Remote	P.I. Orig.	Plan. Elab.	App.
With-Inst. vs. Prog.-Alone	A	3.04**	3.04**	<1.00	2.74**	1.53	1.29	2.05*	<1.00
With-Inst. vs. Control School	A	5.96**	5.64**	4.24**	6.74**	2.71**	3.67**	4.98**	2.58*
With-Inst. vs. Control School	C	6.08**	5.73**	4.56**	6.97**	2.82**	3.91**	4.93**	2.75**
With-Inst. vs. Inst.-School Control	C	4.80**	4.97**	3.17**	5.32**	2.40*	2.91**	4.35**	<1.00
Inst.-School Control vs. Control School	C	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.39
Prog.-Alone vs. Control School	A	2.90**	2.08*	4.86**	3.99**	1.19	2.39*	2.93**	2.30*
Prog.-Alone vs. Control School	B	2.95**	2.06*	4.90**	4.05**	a	2.59*	3.16**	2.50*
Prog.-Alone vs. Prog.-School Control	B	1.10	2.23*	2.04*	3.33**	a	3.91**	3.04**	1.20
Prog.-School Control vs. Control School	B	<1.00	<1.00	1.38	<1.00	a	-2.08*	<1.00	<1.00

Note: For each test included in this table, analysis of covariance showed a significant Group effect and a nonsignificant Schools by Groups interaction (except as indicated by Note a). The body of the table gives values of t computed with denominator based on within-cells variances of indicated run (Lindquist, 1956, p. 327). The df of t is the same as the df of the within-cells variance of the indicated run.

a. F's for Groups and interaction in analysis of covariance not significant.
* $p < .05$
** $p < .01$

Table 7

Comparisons of Adjusted Post-test Means (from Analyses of Covariance):
II. Comparisons of Groups in Separate School Types

Groups Compared	Run	Assoc. Fluency Type I Schools	Assoc. Fluency Type II Schools	Other Uses Type I Schools	Other Uses Type II Schools
With-Inst. vs. Prog.-Alone	A	-2.57*	<1.00	2.58**^{a}	
With-Inst. vs. Control School	A	<1.00	4.05**	4.70**^{a}	
With-Inst. vs. Control School	C	<1.00	4.40**	3.12**	6.02**
With-Inst. vs. Inst.-School Control	C	<1.00	2.43*	1.58	5.78**
Inst.-School Control vs. Control School	C	<1.00	<1.00	-1.91	-1.44
Prog.-Alone vs. Control School	A	1.79	4.17**	2.34*^{a}	
Prog.-Alone vs. Control School	B	1.83	4.02**	2.48*^{a}	
Prog.-Alone vs. Prog.-School Control	B	2.35*	<1.00	3.65**^{a}	
Prog.-School Control vs. Control School	B	-1.09	2.56*	-1.83^{a}	

Note: For both tests included in this table, analysis of covariance showed a significant Schools by Groups interaction (except as indicated by Note a). The body of the table gives values of t computed with denominator based on within-cells variances of indicated run (Lindquist, 1956, p. 327). The df of t is the same as the df of the within-cells variance of the indicated run.

a. F for interaction nonsignificant, F for Groups significant.
* $p < .05$
** $p < .01$

groups, and Table 8 summarizes the interpretations of the outcomes of these tests. In Tables 6 and 7, a negative value of t means that the second group listed in the row had a greater mean than the first group, and a positive value means that the first group had the greater mean. Table 6 summarizes comparisons of the separate groups in each run in which the main effect of Groups was significant and the School Types by Groups interaction was non-significant. These comparisons showed that the Instructor-School Control groups were not significantly different from the Control School groups in any of these runs; and the Program-School Control was significantly different from the Control School group only in Run B on Product Improvement Originality. The With-Instructor group was significantly superior to the Control School group on all ability tests. The With-Instructor group was also superior to the Instructor-School Control group on all of these tests, significantly so on all but the Apparatus test. The Program-Alone group was superior to the Control School group on all ability tests, and the difference was significant on all tests except Consequences Remote. The Program-Alone group was also superior to the Program-School Control group on all ability tests, significantly so on all except Apparatus, Consequences Remote, and Consequences Total. The With-Instructor group was significantly superior to the Program-Alone group on Planning Elaborations, Consequences Total, and Product Improvement Fluency and Flexibility, but was not significantly different from the Program-Alone group on Alternate Uses, Apparatus, Product Improvement Originality, and Consequences Remote.

On the two tests on which there was a significant School Types by Groups interaction, the groups were compared separately within each School Type. These comparisons are summarized in Table 7. In general, differences were more often significant in the Type II schools than in the Type I schools. In the Type I schools on Associational Fluency, the Program-Alone group was significantly superior to the With-Instructor group and the Program-School Control group, and was superior to the Control School group at the .10 level of significance. No other differences approached significance. In the Type II schools on Associational Fluency, the pattern of results was essentially the same as for the tests on which the interaction was not significant, except that the Program-Alone group was not significantly different from the Program-School Control group, which in turn was significantly superior to the Control School group.

Table 8

Summary of Results of Analyses of Covariance and t Tests

Test	Significant Effects	Interpretation of Significant Effects
Assoc. Fluency	A G(.001), G x S(.005)	Type I Schools: Prog.-Alone > With-Inst. and > Control School (.10); With-Inst. = Control School. Type II Schools: With-Inst. = Prog.-Alone; both > Control School.
	B G(.001), G x S(.05)	Type I Schools: Prog.-Alone > Prog.-School Control; neither diff. from Control School. Type II Schools: Prog.-Alone = Prog.-School Control; both > Control School.
	C G(.05), G x S(.005)	Type I Schools: no sig. diffs. among With.-Inst., Inst.-School Control, & Control School. Type II Schools: With-Inst. > Inst.-School Control & Control School; Control gps. =.
Other Uses	A G(.001)	With-Inst. > Prog.-Alone > Control School.
	B G(.001)	Prog.-Alone > Prog.-School Control & Control School; Control School > Prog.-School Control at .10 level.
	C G(.001), G x S(.025)	Type I Schools: With-Inst. > Inst.-School Control, but not diff. from Control School; Control gps. =. Type II Schools: With-Inst. > Inst.-School Control & Control School; Control gps. =.
Conseq. Total	A G(.001)	With-Inst. > Prog.-Alone > Control School.
	B G(.025)	Prog.-Alone > Control School; Prog.-School Control = Prog.-Alone & Control School.
	C G(.001)	With-Inst. > Inst.-School Control & Control School; Control gps. =.

(Continued on Page 41a)

Table 8 (continued)

Test	Significant Effects	Interpretation of Significant Effects
P.I. Fluency	A G (.001)	With-Inst. > Prog.-Alone > Control School.
	B G (.05)	Prog.-Alone > Prog.-School Control; Control School = Prog.-Alone & Prog.-School Control.
	C G (.001)	With-Inst. > Inst.-School Control & Control School; Control gps. =.
Alt. Uses	A G (.001)	With-Inst. = Prog.-Alone; both > Control School.
	B G (.001)	Prog.-Alone > Prog.-School Control & Control School; Control gps. =.
	C G (.001)	With-Inst. > Inst.-School Control & Control School; Control gps. =.
P.I. Flexibility	A G (.001)	With-Inst. > Prog.-Alone > Control School.
	B G (.001)	Prog.-Alone > Prog.-School Control & Control School; Control gps. =.
	C G (.001)	With-Inst. > Inst.-School Control & Control School; Control gps. =.
Conseq. Remote	A G (.05)	With-Inst. > Control School; Prog.-Alone = With-Inst. & Control School.
	B No sig. effects	No sig. diffs. among Prog.-Alone, Prog.-School Control, & Control School.
	C G (.01)	With-Inst. > Inst.-School Control & Control School; Control gps. =.
P.I. Originality	A G (.005)	With-Inst. = Prog.-Alone > Control School.
	B G (.001)	Prog.-Alone > Control School > Prog.-School Control
	C G (.001)	With-Inst. > Control School = Inst.-School Control.

(Continued on Page 41b)

Table 8 (continued)

Test	Significant Effects	Interpretation of Significant Effects
Planning Elab.	A G (.001)	With-Inst. > Prog.-Alone > Control School.
	B G (.005)	Prog.-Alone > Prog.-School Control & Control School; Control gps. =.
	C G (.001)	With-Inst. > Inst.-School Control & Control School; Control gps. =.
Apparatus	A G (.025)	With-Inst. = Prog.-Alone; both > Control School.
	B G (.05)	No sig. diffs. among Prog.-Alone, Prog.-School Control, & Control School (but Prog.-Alone > Control School at .10 level).
	C G (.025)	With-Inst. > Control School; Inst.-School Control = With-Inst. & Control School.
C.P.I. Dominance	A, B, C No sig. effects	No sig. diffs. among With-Inst., Prog.-Alone, Control School, & the Prog.-School & Inst.-School Controls.

G = Group
S = School Type
">" = better than (sig.)

On Other Uses, the interaction was significant only in Run C, and as shown in Table 7, there was no discrepancy between the comparison of the With-Instructor and Control School groups based on Run A and the comparisons of these groups based on Run C. The interaction in Run C apparently resulted primarily from a difference between the School Types in the comparison of the With-Instructor and Instructor-School Control groups. The difference between these groups was significant only in the Type II schools.

In summary, the pattern of results on the various tests of creative ability permits the generalization that the With-Instructor groups were superior to the Program-Alone groups and to both Control groups; and the Program-Alone groups were superior to both Control groups. The tests most representative of this outcome were Planning Elaboration, Product Improvement Fluency, and Product Improvement Flexibility: and Alternate Uses, Other Uses, Product Improvement Originality, and Consequences Total gave essentially the same pattern of results. Associational Fluency yielded different results in the two School-Types. On this test the experimental treatments were more effective in the Type II schools than in the Type I schools. The Consequences Remote test showed results that were partly consistent with the generally obtained pattern, since the With-Instructor group was significantly superior to the Control groups on this test. On the Apparatus test, the Experimental groups were not significantly different from each other, nor from their respective In-the-Same-School Controls, but each was significantly superior to the Control School group.

C. ANALYSIS OF STUDENT REACTIONS

Regarding students' own reactions to the course, the analysis on pages 44 to 52 presents reactions of the students who took the program without an instructor as compared with those who had an instructor-taught programmed course. It is interesting to note that, even though the instructor-taught students found the course more interesting and felt they gained more from it, both groups, in their total comments, appeared to report equal application of what they had learned and seemed to feel they would apply it equally well in the future.

Statements 32 and 36 in the analysis are particularly interesting. Regarding number 32, 59.7 per cent of the Program-Alone students expected something of the course which didn't materialize, while this was quite dissimilar for the With-Instructor students. The "something" that didn't materialize was the class discussion with an instructor. This was mentioned repeatedly in the comments. (Note also number 41 in the analysis.[1]) Evidently the Program-Alone students had all hoped (and perhaps assumed), when volunteering, that they would end up in an instructor-taught class. As to number 36, it appears that the With-Instructor students are not in as much need for "progress-feedback" as are the Program-Alone subjects. The Program-Alone subjects reported more encouragement from the feedback on the periodic five-minute test-exercises than did the students with an instructor even though the latter made greater progress on the exercises!

Hundreds of pages of comments by the students have been amassed as a result of three sources of "open-ended" feedback from the experimental students: (1) the "comment" sections and open-ended questions in the final questionnaire (see complete form in Appendix G); (2) session-by-session "reaction" questionnaires completed by all students at the end of each of the 26 sessions; (3) one-page summaries by all students of their overall reactions to the course at approximately one-third and two-third intervals through the course. All of this material is being studied further by various members of the staff. A counselor's summary-interpretation of (2) above is provided in Appendix A.

Much of the total feedback is reflected in the analysis on the following pages. However, a great deal of further insight is provided by a study of the written reactions. It is hoped that this may be further summarized and interpreted in the future.

A study of the data on the following pages indicates that the students were quite candid in their reactions. The questionnaire was intentionally designed so that the most favorable response to each question comes last. Thus any tendency toward checking the first response that one reads would serve to reduce the benefits reported rather than to increase them.

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[1] Additional questions were included for those students taking the programmed course without an instructor. A summary of their added responses is shown as statements 37 to 51 on pages 52 to 54.

ANALYSIS OF STUDENT REACTIONS

The following directive was given to the participating students:

> IMPORTANT: This course was an educational experiment. Many other students in the future will be affected by decisions that will be based on your reactions as the first "test pilots" of the present course. Therefore, your answers and comments on this questionnaire are highly significant. Please read each question carefully, and give serious thought to your answers and comments. Be completely frank in your appraisal. No one at your school will see these papers; only the research staff at the University will work with the questionnaires. Furthermore, your answers and comments will in no way affect your grade. All students who have been asked to fill out this questionnaire have received an "S" grade already for the course.
>
> Please circle one reaction in each multiple-choice statement, and provide as much information as possible for each item.

The students responded to the statements as indicated below. The figures represent percentages based on the total number of students in each group (generally 62 + 62, or a total of 124 in all, although in a few cases not every student responded to a particular question).

1. Items Concerned with Perceived Gain

Statement 1 - I find myself more observant than before the course.

	not at all	very little	somewhat	good deal	great deal
Programmed students	1.6	11.3	53.2	25.8	8.1
Instructed students	0.0	4.7	48.4	29.7	17.2
All students	0.8	7.9	50.8	27.8	12.7

Statement 2 - I find myself more open-minded to ideas of others than before the course.

	not at all	very little	somewhat	good deal	great deal
Programmed students	16.1	19.4	29.0	24.2	11.3
Instructed students	0.0	3.2	36.5	47.6	12.7
All students	8.0	11.2	32.8	36.0	12.0

Statement 3 - I find that I am more prone to try different approaches to doing something or to attacking a problem than before the course.

	no	I doubt it	not necessarily	probably	definitely
Programmed students	0.0	3.3	18.3	43.3	35.0
Instructed students	1.6	0.0	14.3	39.7	44.4
All students	0.8	1.6	16.3	41.5	39.8

Statement 4 - I find I tend to take more factors into consideration in making decisions than before the course.

	no	I doubt it	not necessarily	probably	definitely
Programmed students	4.7	9.4	10.9	40.6	34.4
Instructed students	0.0	1.6	8.1	35.5	54.8
All students	2.4	5.6	9.5	38.1	44.4

Statement 5 - I find myself more self-confident than before the course.

	not at all	very little	somewhat	good deal	great deal
Programmed students	21.0	21.0	33.9	21.0	3.2
Instructed students	9.8	19.7	47.5	21.3	1.6
All students	15.4	20.3	40.7	21.1	2.4

Statement 6 - I find myself a more active participant in discussions than before the course.

	not at all	very little	somewhat	good deal	great deal
Programmed students	33.9	19.4	27.4	12.9	6.5
Instructed students	12.9	22.6	48.4	12.9	3.2
All students	23.4	21.0	37.9	12.9	4.8

Statement 7 - I find myself more inquisitive than before the course.

	not at all	very little	somewhat	good deal	great deal
Programmed students	13.3	31.7	31.7	20.0	3.3
Instructed students	3.2	12.7	38.1	38.1	7.9
All students	8.1	22.0	35.0	29.3	5.7

Statement 8 - I find since taking the course that I tend to exert more effort in mental tasks rather than quitting so soon.

	no	I doubt it	I don't know	I think so	definitely
Programmed students	7.9	6.3	23.8	39.7	22.2
Instructed students	3.2	1.6	19.4	40.3	35.5
All students	5.6	4.0	21.6	40.0	28.8

Statement 9 - I find myself more aware of problems and challenges than before the course.

	not at all	very little	somewhat	good deal	great deal
Programmed students	12.5	12.5	34.4	28.1	12.5
Instructed students	1.6	14.3	30.2	39.7	14.3
All students	7.1	13.4	32.3	33.9	13.4

Statement 10 - I find myself better able to cope with problems than before the course.

	not at all	very little	somewhat	good deal	great deal
Programmed students	7.8	15.6	39.1	28.1	9.4
Instructed students	0.0	9.7	30.6	48.4	11.3
All students	4.0	12.7	34.9	38.1	10.3

Statement 11 - I find I am better able to think up effective ideas than before the course.

	not at all	very little	somewhat	good deal	great deal
Programmed students	3.2	9.7	43.5	30.6	12.9
Instructed students	1.6	6.5	32.3	38.7	21.0
All students	2.4	8.1	37.9	34.7	16.9

Statement 12 - I find I am better able to evaluate my ideas than before the course.

	not at all	very little	somewhat	good deal	great deal
Programmed students	4.8	16.1	35.5	35.5	8.1
Instructed students	0.0	3.2	35.5	40.3	21.0
All students	2.4	9.7	35.5	37.9	14.5

Statement 13 - I find I am better able to develop my ideas and put them to use than before the course.

	not at all	very little	somewhat	good deal	great deal
Programmed students	3.3	20.0	38.3	30.0	8.3
Instructed students	6.7	8.3	38.3	36.7	10.0
All students	5.0	14.2	38.3	33.3	9.2

2. Items Concerned with PRESENT Application

Statement 14 - I have found the course helpful in my school studies.

	not at all	very little	somewhat	good deal	great deal
Programmed students	18.8	26.6	35.9	7.8	10.9
Instructed students	16.1	33.9	32.3	6.5	11.3
All students	17.5	30.2	34.1	7.1	11.1

Statement 15 - I found the course helpful in my life's activities in general.

	not at all	very little	somewhat	good deal	great deal
Programmed students	12.9	30.6	37.1	14.5	4.8
Instructed students	7.9	19.0	44.4	22.2	6.3
All students	10.4	24.8	40.8	18.4	5.6

3. Items Concerned with FUTURE Application

Statement 16 - I think I will be able to apply what I learned in this course in my future life.

	no	I doubt it	maybe	probably	yes
Programmed students	3.2	3.2	21.0	30.6	41.9
Instructed students	1.6	0.0	27.0	30.2	41.3
All students	2.4	1.6	24.0	30.4	41.6

Statement 17 - As compared with my favorite high school course, I think this course will prove valuable in my life.

	to a much lesser extent	to a lesser extent	about the same	to a greater extent	to a much greater extent
Programmed students	11.1	42.9	20.6	17.5	7.9
Instructed students	3.2	29.0	33.9	29.0	4.8
All students	7.2	36.0	27.2	23.2	6.4

Statement 18 - As compared with my high school courses in general, I think this course will prove valuable in my life.

	to a much lesser extent	to a lesser extent	about the same	to a greater extent	to a much greater extent
Programmed students	4.8	22.2	34.9	28.6	9.5
Instructed students	4.8	20.6	39.7	23.8	11.1
All students	4.8	21.4	37.3	26.2	10.3

4. Items Concerned with Interest and Involvement

Statement 19 - I think the course should have been

	eliminated as of no real value	reduced in length	about what it was	expanded to more sessions per week	expanded to a full year
Programmed students	1.7	15.5	41.4	13.8	27.6
Instructed students	3.2	1.6	32.3	30.6	32.3
All students	2.5	8.3	36.7	22.5	30.0

Statement 20 - I would have preferred to drop out of the course if I had been given the opportunity.

	definitely	at many points	sometimes	rarely felt that way	never wanted to
Programmed students	3.3	14.8	49.2	16.4	16.4
Instructed students	1.6	1.6	38.0	31.7	27.0
All students	2.4	8.1	43.5	24.2	21.8

Statement 21 - As compared with my favorite high school course, I found this course

	much less interesting	less interesting	about the same	more interesting	much more interesting
Programmed students	28.6	47.6	12.7	6.3	4.8
Instructed students	4.8	33.9	30.6	21.0	9.7
All students	16.8	40.8	21.6	13.6	7.2

Statement 22 - As compared with my high school courses in general, I found this course

	much less interesting	less interesting	about the same	more interesting	much more interesting
Programmed students	10.0	25.0	35.0	21.7	8.3
Instructed students	1.6	11.1	33.3	39.7	14.3
All students	5.7	17.9	34.1	30.9	11.4

Statement 23 - I found the sessions

	much too repetitious	too repetitious	moderately repetitious	slightly repetitious	not at all repetitious
Programmed students	16.7	30.0	31.7	13.3	8.3
Instructed students	1.6	9.5	46.0	31.7	11.1
All students	8.9	19.5	39.0	22.8	9.8

Statement 24 - I found the course as a whole

	not at all enjoyable	not very enjoyable	so-so	enjoyable	very enjoyable
Programmed students	4.8	15.9	36.5	34.9	7.9
Instructed students	1.6	0.0	27.0	50.8	20.6
All students	3.2	8.0	31.7	42.9	14.3

Statement 25 - I would like to take an advanced course in Applied Imagination in college, if I had the chance to do so.

	no	I doubt it	maybe	probably	definitely
Programmed students	13.1	14.8	27.9	21.3	23.0
Instructed students	3.2	14.5	35.5	17.7	29.0
All students	8.1	14.6	31.7	19.5	26.0

Statement 26 - If my best friend then asked me if he should take this course, I would say

	definitely no	no	maybe	yes	by all means
Programmed students	3.4	5.1	35.6	37.3	18.6
Instructed students	0.0	0.0	12.9	40.3	46.8
All students	1.7	2.5	24.0	38.8	33.1

5. Additional Items

Statement 27 - I think I will be able to make use of what I learned in my education after high school.

	not at all	very little	somewhat	good deal	great deal
Programmed students	1.6	6.2	35.9	29.7	26.6
Instructed students	1.7	5.0	28.3	33.3	31.7
All students	1.6	5.6	32.3	31.5	29.0

Statement 28 - I feel the training would be best if given*

	in grade school	in jr. high school	earlier in high school	during sr. year when it was given	in college
Programmed students	29.5	13.1	24.6	24.6	8.2
Instructed students	13.1	9.8	52.5	23.0	1.6
All students	21.3	11.5	38.5	23.8	4.9

Statement 29 - I think a course like this should be

	not offered at all	elective to college-prep only	elective to all students	required of all college-prep students	required of all students
Programmed students	1.6	7.9	59.4	9.4	21.9
Instructed students	0.0	6.5	59.7	8.1	25.8
All students	0.8	7.1	59.5	8.7	23.8

Statement 30 - I would recommend a course like this to

	no students	some students	most students	all students
Programmed students	3.3	38.3	35.0	23.3
Instructed students	0.0	32.2	32.3	35.5
All students	1.6	35.2	33.6	29.5

Statement 31 - If I had fully realized the nature of the course when the experimental volunteers were sought, I probably would have volunteered to spend the semester on the sessions.

	no	yes
Programmed students	20.0	80.0
Instructed students	14.0	86.0
All students	17.1	82.9

Statement 32 - Did you expect something of the course which didn't materialize?

	yes	maybe	no
Programmed students	59.7	17.7	22.6
Instructed students	20.6	23.8	55.6
All students	40.0	20.8	39.2

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*One additional category, "never," received no responses.

Statement 33 - I have discussed the course at home

	not at all	very little	somewhat	good deal	great deal
Programmed students	11.3	19.4	33.9	22.6	12.9
Instructed students	11.1	22.2	27.0	28.6	11.1
All students	11.2	20.8	30.4	25.6	12.0

Statement 34 - I have discussed the course with my friends*

	not at all	very little	somewhat	good deal	great deal
Programmed students	11.1	36.5	31.7	12.7	7.9
Instructed students	20.6	38.1	36.5	1.6	3.2
All students	15.9	37.3	34.1	7.1	5.6

Statement 35 - Regarding the yellow "take-home" pages:

1. I worked on them	never	rarely	sometimes	usually	always
Programmed students	10.0	23.3	38.3	23.3	5.0
Instructed student	12.7	30.2	38.1	17.5	1.6
All students	11.4	26.8	38.2	20.3	3.3

2. I read them	never	rarely	sometimes	usually	always
Programmed students	0.0	11.5	19.7	39.3	29.5
Instructed students	4.8	19.4	33.9	27.4	14.5
All students	2.4	15.4	26.8	33.3	22.0

3. I	disliked them	was neutral to them	enjoyed them	never looked at them, so I don't know
Programmed students	13.8	51.7	31.0	3.4
Instructed students	6.3	61.9	23.8	7.9
All students	9.9	57.0	27.3	5.8

4. I found them to be	useless	of little help	of some help	of great help
Programmed students	15.3	27.1	47.5	10.2
Instructed students	9.8	21.3	63.9	4.9
All students	12.5	24.2	55.8	7.5

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*Students were told not to discuss the course with others in the school because of the "in-school" control subjects. Hence many of them commented that they didn't discuss with friends because they were told not to do so.

Statement 36 - I found the periodic five-minute tests to be

	very discouraging	discouraging	without effect	encouraging	very encouraging
Programmed students	0.0	5.0	20.0	53.3	21.7
Instructed students	0.0	4.8	43.5	45.2	6.5
All students	0.0	4.9	32.0	49.2	13.9

Additional questions were included for those students taking the programmed course without an instructor. A summary of their added responses follows.

Statement 37 - Before this course I heard or read about programmed instruction

never	very little	some	quite a bit	a great deal
37.1	25.8	25.8	6.5	4.8

Statement 38 - My own previous experience with programmed-instruction material has been

non-existant	very slight	moderate	appreciable	extensive
58.1	19.4	14.5	6.5	1.6

Statement 39 - I found this form of instruction

very distasteful	distasteful	acceptable	pleasant	highly enjoyable
21.0	22.6	30.6	17.7	8.1

Statement 40 - I believe that I learned through this form of instruction

terribly	poorly	passably	capably	superbly
3.2	8.1	46.8	38.7	3.2

Statement 41 - If I had been given the opportunity to talk over the work in the booklets, I would have felt differently about the course.

no	I doubt it	maybe	probably	yes
3.2	3.2	16.1	16.1	61.3

Statement 42 - If you answered "yes," "probably," or "maybe" to #41 (above), how often do you think discussions should be held?

after each booklet	once a week	every other week	about once a month	a few times during the semester
53.7	29.6	13.0	1.9	1.9

Statement 43 - If I had spent the same amount of time we spent in these classes in studying a regular textbook in Applied Imagination, with no instructor, I feel that I would have accomplished

much more	more	about the same	less	much less
1.6	3.3	42.6	36.1	16.4

Statement 44 - As compared with the self-instructional booklets we used in the course, I think I would have enjoyed spending the time studying a regular textbook on the subject, with no instructor

much more	more	about the same	less	much less
3.3	6.6	21.7	33.3	35.0

Statement 45 - I would have preferred listening to lectures during

all sessions	most sessions	half of the sessions	a few of the sessions	none of the sessions
11.5	18.0	18.0	45.9	6.6

Statement 46 - If I wanted to learn more about creative problem-solving, I would use additional programmed instructional materials

only as a last resort	with much hesitation	maybe yes, maybe no	without much hesitation	in preference over all other forms of instruction
12.9	11.3	48.4	24.2	3.2

Statement 47 - I think programmed instruction should be used in future courses in Applied Imagination

never	seldom	occasionally	often	always
4.8	12.9	45.2	29.0	8.1

Statement 48 - If someone were going to rewrite the program I took, I would recommend generally:

make most pages much harder	make most pages harder	leave them about as is	make most pages easier	make most pages much easier
3.5	17.5	68.4	10.5	0.0

Statement 49 - Regarding single word fill-ins, what would you suggest?

Don't use at all	Use sparingly	Use about as is	Use even more extensively	Use entirely
7.9	39.7	41.3	7.9	3.2

Statement 50 - Did it tend to discourage you when you found a different response than you had filled in on a page?

never	rarely	sometimes	usually	always
23.8	31.7	38.1	4.8	1.6

Statement 51 - It has been suggested that all responses be left off the back of the pages, inasmuch as the responses the students write are almost always appropriate. What do you think of this idea?

very poor	poor	fair	good	excellent
19.7	37.7	14.8	14.8	13.1

DISCUSSION

The results show that the instructor-presented program was more effective than the program taken alone by the student, but that both increased creative behavior significantly.

The principal investigator felt, as the experimental course proceeded, that the students who worked on their own would do better because of the intense effort they appeared to exert, page by page. He felt so in spite of the fact that these students, in general, showed less interest in the course than did the instructor-taught students. It was thought that the interaction benefits of the instructor-taught class would heighten interest but would not necessarily produce greater gains in creative ability. The latter gains, it was felt, would be greater for the students who did every page and exercise laboriously on their own.

However, the interaction benefits in the conventional classes evidently contributed more to the learning than did the seemingly intense effort on the part of the subjects who took the program alone. On reflection, it may well be that each of the interacting students was thinking just as intensely as the programmed subjects, but simply not making constant overt responses. And recent programming literature indicates that active responding does not necessarily lead to better learning (Schramm, 1964).

It should be noted that certain students enjoyed the programmed booklets immensely. For example, one commented enthusiastically, "This puts me in the driver's seat!" It is also important to point out that no discussion at all was allowed between the proctor and the students who took the program on their own. This was done in order to get a picture of the results where there was no teacher influence. The proctor merely greeted the students on arrival. Any questions were related back to the booklets. The only comments made about the material were the general announcements shown in Appendix F. vi. Many times the proctors wanted very much to discuss something with a student, or to make an appropriate comment, but did not do so because of the rigid experimental situation. In normal usage, the programs could be dealt with much more flexibly, as has already been done in the pilot work in the classes in the spring following the major experiment.

It is highly interesting with respect to the above comments to study the following discussion of James et al. (1962) regarding the creativity-development course they evaluated in their Cooperative Research Project with the U.S. Office of Education:

> As noted elsewhere in this report, our cognitive-skills approach, on its simpler levels, reduces the role of the instructor to that of an administrator who presents practice devices to participants. Thus we see few obstacles, other than development costs, to the development of automated teaching of the basic skills in innovative thinking. However, on more complex levels the need for discussion and personal attention appear indispensable. A combination of two approaches, an automated cognitive-skills method, and a personality-insight focus might be used simultaneously. Such a course ought to involve the characteristic opening-closing phasic alternation we discussed above. "Closed" practice would alternate with "open" instruction and participant interaction.

Variations and Improvements. In college classes the principal investigator has done what James advocates; i.e., he has provided the programmed booklets as homework assignments and has used the class time for discussion, amplification, and interaction experiences. This has seemed to work out exceedingly well, although it has not been subjected to rigorous scientific testing. It has the further benefit of not limiting students' time to one class-period for each booklet. Many of the college-students spent as much as two or three hours each on some of the booklets when doing them at home. Furthermore, when they receive them as homework, they are able to work on the booklets at the time and place which feels most comfortable for them. Many report taking extended "incubation" breaks--others report beneficial effects of music while working on the booklets. Students mention many other special techniques that are suggestive of interesting and potentially valuable studies.

In improvements that are suggested session-by-session by students, there are many other leads worth exploring. For example, there may be definite value in providing more materials to handle, as well as more illustrations and cartoons. These ideas are used in several booklets and appear to be very successful. Research needs to be carried out to test out their effectiveness, and if confirmed, to develop ways of integrating the ideas more fully with all or most of the booklets.

It is appropriate to note that the task of programming teaches the instructor a great deal about his course, and raises scores of new questions as well. For example, because of what was learned, it became apparent that it was important to rearrange the sequence of the course. Originally, all of the principles were taught first, using practice exercises; then the students were taught how to apply the principles to their own problems. The course now allows for intermingling of problem exercises with students' practice on their own problems. It makes the program much more meaningful to the student.

Future Research Questions. There are many future questions to be answered. For example, there are scores of alternate sequencing patterns to try. Also, there are many specific booklets to refine further and test individually. Considerable pilot work in this respect was carried out with SUNY/B classes, but no attempt was made to do this under the rigorous experimental procedures that were followed for the total group of booklets that were evaluated (as an entire course) in the final experiment.

Fred Amram, an instructor at the University of Minnesota, gave the single booklet on "Evaluation" to students in one of his speech classes, as a homework assignment. He found, in subsequent testing, that the students could not intellectualize about "criteria" for evaluation, but that they could think up criteria and apply them in evaluative tasks. He claims that the students reacted very well to using the self-instructional booklet. Many controlled experiments could be designed around specific booklets already available in the series.

The research provided much more abundant data than could be fully evaluated at the present. There are many interesting questions raised by the specific items in the tables of correlations. Other correlations can also be computed between the test data and the data provided by the questionnaires. Results of the extended effort on originality can be studied, as mentioned earlier. Also, all of the pilot data provided by both the spring classes and the extra two schools is available for study.

The abundance of additional information obtainable pertains not only to the test data but also to the raw data (responses) within each programmed booklet. For instance, no attempt was made to determine which particular booklet increased a particular creative trait. In effect, the full program is a "shot-gun" approach to the task of nurturing creative ability. A "rifle" approach will now take years of experimentation with individual booklets, plus modifications and changes of sequence of same.

It is intended to make further analyses of the test data from the present experiment in order to attempt to explore the following: what type of person gains most from the course, and what are the different reactions to the course on the parts of different personality-types?

An entire series of experiments could be designed to adapt the programs to younger levels and to specific types of students, such as the gifted, the retarded, senior citizens in adult education courses, etc.

Additional questions for further research might include the following:

1. How does the poorer reader fare in such a program? What side effects may it have on his reading ability?
2. What would longitudinal studies show regarding both the retention and transfer of the training? (Additional test results are already available from groups of the experimental subjects who repeated the ability tests again a full semester after completing the course.)
3. What additional factors in Guilford's "Structure-of-the-Intellect" are being affected by the training?
4. What are the differential effects of verbally vs. non-verbally oriented programs?
5. What effects would occur if students' booklets were returned to them to keep, or if the students were allowed to keep them without even turning them in?
6. What would be the effects of a team approach (without teacher) wherein students showed one another their responses to certain exercises and discussed them with one another as they worked through the booklets?

Conclusion. Thurstone (1924) wrote: "That teacher is more fortunate who realizes that the starting-point for the educative process is in the child's own mind, and that the tools of education are merely the means whereby we attempt to induce the child to express its own self in a direction that may be ultimately advantageous."

The present study provides data which show the effectiveness of such education in creative problem-solving at the high-school level, as well as a tested program for application in high schools. Thus, secondary-school educators who would like to offer entire creative problem-solving courses, or aspects of these courses, will have tested materials available to them when the booklets can be made available in published form.

Plans are being made to suggest alternative ways of introducing the self-instructional programs, so as to allow for interaction of students with an instructor who is not highly trained in the creative problem-solving instructional methods. With the help of the instructional booklets, such instructors may be able to conduct effective courses that allow students the opportunity for discussion and group participation--an important element in any study of creative problem-solving. Also, ideas will be suggested for incorporating parts of the materials as is within present academic subjects, as in the example of the "Evaluation" booklet cited on page 57. These ideas will be spelled out in detail in a manual to accompany the final programmed course when it is published. And, last but far from least, there remains, of course, the huge task of finding ways to integrate the programmed principles of creative thinking within emerging programs in subject-matter courses. This was stressed early in this report as a next stage for subsequent research.

Meanwhile, the majority of the material has been integrated into the Instructor's Manual and Workbook for Creative Problem-Solving Institutes and Courses, published by the Creative Education Foundation in Buffalo. These publications are in a form similar to that used by the instructors who used the programmed approaches in the "instructor-taught" groups of the present experiment.

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A COUNSELOR'S COMMENTS REGARDING EXPERIMENTAL COURSE

(Based on an exhaustive analysis of all 28 booklets completed by each of the 62 experimental students.)

by Antoinette Paterson, Research Associate

Every human being has a creative urge and feels it. The course provides a comfortable recognition, understanding and use of this creative urge.

Life-environment does not appear to allow full-play to our creative energy.

If we want young human animals to command their nature, we must nourish their necessary acts toward obedience to that nature. Too much of our effort has been wasted trying to command their nature for them, out of obedience to our own cultural stereotypes.

As educators with structured curricula, we are faced with the dilemma of accommodating the unstructured, spontaneous, curiosity-suggestions, curiosity-questions.

We wind up fighting the student's need to express himself creatively.

Eventually, in order to get along, he gives up the "self-comfort" image and buries the comfort-urgings out of guilt and shame for having them. We have forced him into imaging an unworthy self - a hostile self. We have forced him into hiding that tortured self away from everyone. He lives alone with his miserable secret. All this guilt and anxiety drains off large quantities of his creative energy. In education, we work with only a trickle of this creative flow because we have dammed up the river of self which contains that powerful mineral - imagination.

In the creative problem-solving course, students are allowed to exercise full play of their imagination while in command of their own process. The student is encouraged to express, develop and discipline his imagination. The main characteristic of this experience for the student has been one of a new-found command of himself. In this way the student recognizes himself as a powerhouse of ideas rather than as a destructive force.

He learns that when he judges, he does so deliberately -- in full awareness that he is judging. This is critical judgment.

At first, as students tried to withhold judgment, there was fatigue and blocking. After they expressed the fatigue and blocking, it became less and less frequent.

Awareness that they could actually judge their ideas ON PURPOSE - ON COMMAND -- caused great recognition that they HAD the ability to discipline their minds.

The students now became much less timid about allowing their imagination to offer up ideas. They felt perfectly capable of "turning off the idea-making" at any time - ON COMMAND, BY THEMSELVES.

Appreciation of their spontaneous and judgmental as both balancing each other -- on their command - gave students a feeling of being able to contribute creatively to their environment.

A Proposal to Buffalo Public Schools for
AN EXPERIMENT IN CREATIVE PROBLEM-SOLVING EDUCATION
for Seniors in the College-Preparatory Program

Creative problem-solving education has been incorporated on scores of campuses throughout the United States, as well as in the Air Force ROTC programs on approximately 200 campuses.[1] A number of experimental studies have evaluated the effectiveness of such training.[2]

The U. S. Office of Education has granted $60,000 toward three years of study at State University of New York at Buffalo to program creative behavior. The hypothesis to be tested in the research is that scores on creative ability tests can be significantly increased through a program developed to present incrementally the principles and procedures of the SUNY/B creative problem-solving course, which has already been evaluated in two experiments reported in the literature.[3] As a by-product, the effect of such a program on the students' attitudes towards the course will also be studied informally. If it is feasible, effects of the training on creative writing in English classes will also be studied.

The first two years of the project, already completed, were devoted to the development and construction of self-instructional materials capable of eliciting creative behavior. Based upon Skinner's programming theory of incremental learning with immediate reinforcement, 26 self-instructional programmed booklets have been constructed to guide the student through creative problem-solving procedures. Methods of immediate reinforcement were provided for various alternate responses rather than for the typical "one right answer." Error analyses were conducted on both naive and trained groups in order to arrive at an optimum program. Five revisions were made in the process.

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[1] Parnes, S.J., & Harding, H.F. (Eds.) A Source Book for Creative Thinking, New York: Scribner's, 1962.

[2] Taylor, C.W. (Ed.) Widening Horizons in Creativity, New York: Wiley, 1964. Also, Taylor, C.W. & Barron, F. (Eds.) Scientific Creativity: Its Recognition and Development, New York: Wiley, 1963.

[3] Major findings were as follows: The course resulted in significant increments on the two measures of quantity of ideas and on three out of the five measures of quality of ideas. In general, these increases in creative productivity remained evident in another group of students tested about a year or more after taking the course. A significant increment on the California Psychological Inventory Dominance Scale also resulted from the course. This scale was devised by its author, Dr. Harrison Gough, "to assess factors of leadership ability, dominance, persistence, and social initiative."

Various versions of these programs have been tried out on the following groups: four creative problem-solving classes at SUNY/B; a group of value engineers at Sylvania's Amherst Laboratories; 250 participants in SUNY/B's Tenth Annual Creative Problem-Solving Institute; one class at Cornell University; and a volunteer group at Hutchinson Technical High School in Buffalo. Revisions have been made based on experiences and error analyses with each of these groups.

There has been growing interest among educators in secondary schools in the creative problem-solving programs. The National Association of Secondary-School Principals has sponsored a general session and a day-long workshop at its past two conventions. Cleveland Heights High School will inaugurate a credit-course this fall. Many other high schools are presently experimenting with creative problem-solving activities. Approximately 60% of the commuters in next fall's freshman class at SUNY/B have elected to attend a voluntary two-day creative problem-solving institute this summer, immediately following their graduation from high school.

The proposed study will provide data on the effectiveness of such education at the high-school level, as well as the possibility of a tested program readily available for application for high schools. Thus, secondary school educators who would like to offer entire creative problem-solving courses, or aspects of these courses, may be able to have tested self-instructional materials available to them.

Plans are being made to suggest numerous alternative ways of introducing the programs, so as to allow for interaction of students with a live instructor who is not necessarily trained in the creative problem-solving instructional methods. With the addition of the instructional booklets, such instructors may be able to conduct effective courses that allow students the opportunity for discussions and group participation -- an important element in any study of creative problem-solving. These ideas will be spelled out in detail in a manual to accompany the final programmed course, if the experimental evaluation indicates that the materials are effective in developing creative behavior.

The Hutchinson Technical High School volunteer group allowed for a pilot test of the adaptability of the self-instructional program to a college-bound high-school senior population. Vocabulary level was found to be suitable. Student attitudes are being surveyed, and scores on pre-post creativity tests will be analyzed and compared with those of a control group of Hutchinson Technical students who were not given the educational program. Post-tests will be adminstered May 24. Attitudes were polled on each separate booklet, and a final informal survey of student attitudes will be made on June 4. The error analyses indicate that the senior high-school students are doing about as well as the SUNY/B students (mostly freshmen). Therefore, unless the analysis of the post-tests of creative ability or the final survey of students indicate strong evidence to the contrary, it seems reasonable to hypothesize that the program can be successfully applied to college-bound high-school seniors.

Hence, we would like to conduct the final experiment with the self-instructional programs on groups of college-bound high-school seniors in the Buffalo Public Schools. The purpose of the final experiment is: (a) to ascertain, by using experimental and control groups in a pre-testing and post-testing design, to what degree the optimum programs (developed and revised as indicated above) increase the students' creative behavior as measured by various tests of creative ability; (b) to determine, by the use of experimental and control groups, whether or not subjects receiving the creative problem-solving training by programmed methods show increases in creative ability to the same extent as do subjects receiving the same training by instructor-taught methods, and whether either or both of these groups show a significant gain in creative ability when compared with control subjects receiving no training.

The sample will consist of three groups, two experimental groups and one control group. Each group will contain approximately 50-60 subjects. Each control group will be matched with each of the experimental groups on the basis of age, educational level, sex, and I.Q., as well as on socio-economic factors if feasible.

The treatment for the E_1 experimental group will be the programmed principles and procedures of creative problem-solving. The treatment for the E_2 experimental group will be its participation in an instructor-taught course of creative problem-solving. The control group will receive no treatment whatsoever. Each of the three groups of 50-60 students will be divided into two classes, one class only from each school. Thus six senior-level college-preparatory groups of 25-30 each would be involved in the experiment. Both instructor-taught classes will be handled by Dr. Sidney J. Parnes, SUNY/B's Director of Creative Education, and principal investigator for the research project. The programmed classes will be handled by Mrs. Dorothy Erismann, a member of the SUNY/B research staff, and a retired English teacher from the Buffalo Public Schools. Either Mrs. Erismann or Dr. Parnes will handle all testing of control groups and experimental groups, as well as all necessary arrangements with the participating high schools.

All subjects would be volunteers, or students signing up for an elective course if it should seem advisable to the school system to offer the creative problem-solving course as an elective. Six different high schools are needed in order to prevent contamination because of subjects discussing the course with one another, and also to minimize possible replication error.

The six experimental and control classes will be divided into two types (ex.: larger and smaller schools) and then randomly assigned to treatments in each type, so that two separate schools will be used for each type of treatment. Comparisons can then be made between schools as well as between experimental treatments. This will be particularly helpful if we are not able to match effectively on socio-economic factors. In that case, three of the more similar schools on those factors will be compared with the three remaining schools, in the following manner:

	Group 1	Group 2	Group 3
Type 1 school	(E_1) Programmed	(E_2) Instructor-taught	Control
Type 2 school	(E_1) Programmed	(E_2) Instructor-taught	Control

If there are not two distinct types of schools, then all six will be randomly assigned as above for statistical analysis.

Group error (and subject error, to some extent) will be minimized by the fact of 26 separate sessions (26 programmed booklets or 26 live instructional sessions of one period each in duration). Subject error will be minimized by the matching of groups on the variables that seem important.

Only those students falling within a restricted range on the control variables will be invited to participate in the experiment: namely, those of normal age-range for seniors in a college-preparatory program, and of an I.Q. range of approximately 110-130. Males and females will be invited to all three groups (experimental and control) in equal proportions. An attempt will be made to invite students of equivalent socio-economic status.

Two obvious advantages of using the Buffalo schools for the experiment are the relative homogenity of the population as compared with suburban schools, and the homogenity of records on the students (I.Q., etc.).

From the total number of each school's students who volunteer or who elect the course, 25-30 will be selected at random, or on a "first come, first served" basis.

The advantage of the elective over the volunteer students would be in the relative certainty of attendance at all sessions. If the elective course is not feasible, the importance of attendance could be stressed to all volunteers when they sign up as subjects.

The proposed schedule for the semester would be as follows:[4]

Two weeks - selection and orientation of subjects.
Two weeks - pre-tests on creativity.
Thirteen weeks - programmed or "live" course (two sessions a week).
Two weeks - post-testing.
One week - discussion of course with students.

The hypotheses of the experiment will be tested by administering a battery of psychological tests of creative ability. These tests will be administered to all experimental and control groups at the beginning of the experiment and also immediately after the course is concluded.

The matching of groups should eliminate differences on the pre-tests. The effectiveness of such matching will be analyzed with t tests of the differences between the experimental and control groups on the initial tests. If the pre-test differences are significant, or even if they are large but non-significant, the data will be analyzed by analysis of co-variance techniques. If the differences are small and non-significant, the data will be analyzed by analysis of variance methods.

All distributions and variances will be examined to ascertain that assumptions are approximately satisfied. If distributions or variances deviate too much from the assumptions, appropriate non-parametric techniques will be used.

NOTE:

Six schools are optimum for the type of experimental design being used. However, the seventh (and most atypical) Buffalo academic high school may be given the opportunity to participate in the experiment by providing a group of students from that school for pilot testing of an alternate sequencing of the booklet, or for a "take-home" version, or for testing the program on a gifted population.

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[4] The control classes, of course, would not receive the thirteen weeks of training or the one-week for discussion of the course.

Initial letter to school Principals C

Millard Fillmore College

STATE UNIVERSITY OF NEW YORK AT BUFFALO

Formerly The University of Buffalo, Founded 1846

Director of Creative Education

Hayes Hall
Administration Road
Buffalo, New York 14214
Telephone 831 - 2208
Area Code 716

September 3, 1965

Mr. Thomas Connors
Principal
South Park High School
150 Southside Parkway
Buffalo, New York

Dear Mr. Connors:

Thanks once again for your outstanding cooperation in our creative education experiment in your high school. We found it extremely helpful to have had you with us for the meeting early this week. The reactions and suggestions we received then will be most useful in enabling us to carry out the research effectively and with a minimum of problems to you and your school.

Mrs. Erismann and I will meet you at your office at least 10 or 15 minutes before the time you scheduled for us to meet your students -- Tuesday at 9:00 a.m., September 14.

As we all agreed, the students to be invited to the 9:00 meeting are all seniors who intend to continue their education after graduating from high school.

An outline of the comments we will make and the points we would like you to stress will be mailed to you in time for you to have it at least a day ahead of the meeting next Tuesday.

Looking forward to meeting with you and your seniors involved on September 14 at 9:00 a.m.

Sincerely yours,

Sidney J Parnes

Sidney J. Parnes
Director

SJP:ap
cc: Dr. Joseph Manch
Dr. Norman Hayes
Mr. Nelson Mercer

Agenda for auditorium meetings of
prospective subjects

D

Millard Fillmore College
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September 9, 1965

MEMORANDUM

To: Principals included in Creative Education experiment

From: Sidney J. Parnes

Time of meeting for Buffalo High School seniors who intend to continue their formal education after graduation:

Agenda:

1. Reading of explanatory sheets by students	10 min.
2. Comments by S. J. Parnes	3 min.
3. Comments by Dorothy Erismann	2 min.
4. Principal's remarks	2-3 min.
5. Students' questions	2-3 min.
6. Students fill in questionnaires	5 min.
7. Collect questionnaires before leaving	

CREATIVE EDUCATION OFFICE
STATE UNIVERSITY OF NEW YORK AT BUFFALO

An Explanation of the
EXPERIMENT IN CREATIVE PROBLEM-SOLVING EDUCATION
For Buffalo High School Seniors Who Intend to Continue Their Formal Education after Graduation

Supported by U. S. Office of Education, Grant No. 7-42-1630-213

BACKGROUND

Change is bewilderingly rapid in our nuclear and space age -- more rapid than ever before. The discoveries and innovations of the next 20 years will probably make the previous 100 years seem to have progressed at a snail's pace.

Therefore, a student cannot foresee exactly what knowledge he will need five or ten years from now to meet life's problems. He can, however, develop attitudes and abilities that will help him meet any future challenge creatively by finding better solutions to problems. The objective of the creative problem-solving course is to help the student do just that. He learns to associate in new ways the knowledge and experience he possesses, as well as the new knowledge and experience he acquires throughout his education and his life. Thus he becomes better able to apply his learning to problems he meets as he progresses through school and into the future.

Creative problem-solving education has been incorporated on scores of college campuses throughout the United States, as well as in the Air Force ROTC programs on approximately 200 campuses. A number of experimental studies have evaluated the effectiveness of such educational programs for college students. For example, in one research project at State University of New York at Buffalo, students who took the course improved both the quantity and quality of their ideas. In addition, their scores on a psychological test showed improvement on a scale designed to measure such factors as leadership ability, dominance, persistence, and social initiative.

With respect to beneficial effects of the creativity programs, several studies have indicated that students do better in subject-matter mastery when they are simultaneously provided with deliberate creativity-development experience in the subject-matter course.

Among educators in secondary schools, there has been growing interest in the creative problem-solving programs. The National Association of Secondary-School Principals has sponsored a general session and a day-long workshop at its past two conventions. Cleveland Heights High School will inaugurate a credit-course this fall. Many other high schools are presently experimenting with creative problem-solving activities. About 350 students in this fall's freshman class at SUNY/B attended a voluntary two-day creative problem-solving institute last summer, immediately following their graduation from high school. Reactions to that institute were excellent, as well as to two earlier institutes attended by other incoming freshmen to SUNY/B.

The U. S. Office of Education has granted $60,000 toward three years of study at State University of New York at Buffalo to develop new, revised programs that nurture creative behavior. The research will ascertain whether college-bound high-school seniors can significantly increase their scores on creative ability tests and other tests associated with creativity as a result of participating in these newly adapted programs, which are based on the courses at SUNY/B that have already been proven there over the past 15 years.

Thus the experiment in the Buffalo high schools will provide scientific data on the effectiveness of creative problem-solving education at the high-school level as well as the possibility of a tested program readily available for application for high schools.

A group of seniors at Hutchinson-Central Technical High School last spring allowed for a pilot test of the adaptability of the educational program to a college-bound high-school senior population. Results were highly encouraging. Therefore, it seems reasonable to attempt a full-scale experiment.

NATURE OF COURSE

The purpose of the course will be two-fold: First, to nurture your personal creativity; second, to enable you to express creative decisions. Creative decisions are dependent on creative observation, observation unhampered by habit.

The course is devoted to the practical application of creative processes. The creative process as applied to problem-solving is essentially as follows:

1. Fact-finding:
    a. Problem-definition--picking out and pointing up the problem.
    b. Problem-preparation--gathering and analyzing data.
2. Idea-finding:
    a. Idea-production--thinking up all possible leads to solution.
    b. Idea-development--reprocessing the resultant ideas by such means as modification and combination.
3. Solution-finding:
    a. Evaluation--verifying the tentative solutions, by tests and otherwise.
    b. Adoption--deciding on and implementing the final solution.

This course will be quite different from most courses you have taken. You will not be asked to "give back information." Rather, you will be asked to think up ideas -- your own ideas -- regarding a variety of problems in need of solutions.

At first, because of the nature of your previous education and experience, you may find this strange. But, as the course progresses, you will become accustomed to applying your creative imagination deliberately and energetically.

During the entire course a "learn by doing" atmosphere will prevail. Thus you will act creatively by meeting challenges and solving problems during the course.

In brief, the course will proceed in the following manner: You will learn by self-demonstration some of the internal and external factors which cripple imagination. A variety of procedures for overcoming these blocks to creative thinking will be presented, and you will participate in brief exercises employing those procedures.

When the course is over you will have a clearer understanding of how to tackle a problem creatively, as well as an appreciation of some of the rewards for creative effort. Also, you will express more freely your creative self.

OBJECTIVES OF COURSE

The following are some of the results this course will help you produce:

1. An attitude of self-confidence in your ability to be deliberately creative.
2. A strong motivation to utilize your creative potential.
3. An open-mindedness to ideas of others.
4. A greater expression of your curiosity -- an awareness of the excitement and challenge in life.
5. A consciousness of the vital importance of creative effort -- in business, in the arts, in the professions, in scientific and technical pursuits, and in personal living.
6. A heightened sensitivity to the problems that surround you -- an attitude of "constructive discontent" towards situations as they exist in your life (that is, a constant desire to improve everything that you do).
7. An increase in abilities associated with creativity, especially the ability to produce quality ideas and original ideas as leads to solutions of problems.

HOW PARTICIPANTS WILL BE CHOSEN AND ASSIGNED

The experiment will be conducted in all of Buffalo's academic high schools, with randomly selected seniors who intend to continue their formal education after graduation. These students are the most similar to a college freshmen group, to whom the creative problem-solving courses have already proven very helpful. Eventually it is hoped that the experimental course can be made available to all high school seniors and perhaps even to younger students.

From those who request to be included in the experiment, students will be randomly assigned (by "chance") to participate this fall. The rest may be given the opportunity to participate in the spring. Of those who are assigned this fall, some will be designated as experimental subjects -- ones who will take the course. Others will be assigned as control subjects -- ones who will not take the course in the fall, but who will definitely be given the opportunity to take the course in the spring.

All students (experimental or control) who are randomly selected from those who request to be included, will receive two periods of tests at the beginning and again at the end of this fall semester. Thus, it will be possible to determine to what extent the control students' creative ability increases as a result of a semester of work in their senior year without any special creativity program. In the case of the experimental students (who are assigned to the special course), the research will enable us to determine to what extent their development in creative ability is enhanced by the program in creative problem-solving, as well as to what extent different methods of presenting the program influence the results. Gains in the creative ability of the "experimental" students (the ones who took the course) will be compared with the gains of the "control" students (who did not take the course), in order to determine any beneficial effects of the program.

Therefore, the "control" student will play as important a part in the experiment as does the "experimental" student. If we learn that his creative ability increases to the same extent without a special program on creative problem-solving, it would indicate that it is not necessary to provide deliberate programs to strengthen creative ability. If, on the other hand, the students who take the course show greater gains in creative ability at the end of the semester than do the control students, the creative problem-solving course might well be worth offering in high schools.

Anyone who requests to be included in the experiment must be willing, if randomly selected, to take the tests at the beginning and at the end of the fall semester, and to attend all class sessions if assigned to one of the experimental groups. This is most important because of the nationwide significance of the experimental results. Test results will be used for research purposes, not for discussion of individual scores with teachers or administrators.

The course will be quite different from any course that high-school students have ever taken. Depending on the group to which an "experimental" student is assigned, he may be learning from a teacher or from programmed booklets. The latter will not allow any opportunity for class discussion. In either case, the student will be doing a great deal of intensive thinking and responding, in a way not demanded of him in most courses in high school or even in college. This may be in a written form, for those working on the programmed materials, or in both written and oral form in the case of the groups taught by a teacher.

In summary, a student who requests to be included will find that the"chance" assignment method, as called for in scientific research studies, may place him in any one of four categories:

1. An experimental subject who takes the course presented by a teacher, and who also takes the tests at the beginning and end of the semester.

2. An experimental subject who takes the course by programmed booklets, and who also takes the tests at the beginning and end of the semester.

3. A control subject who does not take the course this fall, but who takes tests at the beginning and end of the semester. Such subjects will then be offered the course in the spring semester.

4. Not a subject of the experiment at all. Such students will, in the spring, be offered either the course or a complimentary copy of the textbook, Applied Imagination.

TIME AND PLACE

Those requesting to participate will be notified by Monday, September 20, whether or not they are among those selected "by chance" to be included in the experiment this fall. Those to be included will then take two periods of tests. Thereafter they will be notified whether they are to be "experimental" or "control" subjects. The "experimental" students will continue with course sessions throughout the semester (twice a week). "Control" students will report at the end of the semester for final tests and will then be offered the spring-semester course.

Students will be assigned to classes, in their high schools, during their study periods. Each class will meet twice a week during the entire semester. Thus each participant must have two free periods a week to devote to the course. There will be no required outside work. However, if any class session is cancelled because of a holiday, snowstorm, etc., the students will be asked to make up the session during another study period. Before the first testing or class meeting you will be notified of the room number and period.

Any student may request a copy of the report of the results of the experiment when it is completed.

CONCLUSION

Twelve years ago the noted psychologist, Dr J P. Guilford, insisted: "Like most behavior, creative activity probably represents, to some extent, many learned skills. There may be limitations set on these skills by heredity; but I am convinced that through learning one can extend the skills within those limitations." Research has now confirmed Dr Guilford's conviction that creative talent (at whatever level this gift exists in an individual) can be nurtured deliberately.

Creative problem-solving is thus an art, a skill. It takes practice like any other skill. In swimming, we may be able to swim fairly well but not be skillful swimmers. If we discover, by lessons or otherwise, the key points of skillful swimming, and then practice them, we are more likely to become skillful swimmers. In learning to swim, most of the time is spent in practice. The same is true of piano-playing, or of any other skill. Similarly, it takes practice to develop and to improve one's creativeness.

Research has shown that one can learn to recognize and call deliberately on his creative abilities; and he can learn techniques of so doing. The net result for the student can be increased productivity. He may experience the same type of result as when a governor is taken from an automobile which has been held under 50 miles an hour; it now can travel 80 or 90. The motive power is the same, but the output has been enhanced. Similarly, this course will help the student step-up his creative output.

The importance of the planned development of creative behavior is becoming more and more apparent to leaders in all walks of life. Dr. Irving Taylor reports that a committee of 17 leading psychologists placed creativity and its cultivation at the top of a list of areas deserving the highest research priority in the behavioral sciences.

There has been a mounting national concern over the need for a high degree of creativity in the fields of science, technology, government and business, as well as in other areas. Research and education in creative thinking could do much to tap this requisite ability, for the benefit of society, as well as for the individual citizens themselves. This is the primary task to which the

COMMENTS BY S. J. PARNES TO PROSPECTIVE SUBJECTS

We have all been anxiously watching developments in outer space. Not all of us can start to explore outer space now, but you can explore the unchartered "inner space" of your minds through this course in creative problem-solving and applied imagination.

The materials used in this course have been in research and development for over 15 years at "U.B." We have been constructing new vehicles for pioneers to use in exploring their mental powers. Now we are getting ready for "blast-off." Some of you now have the chance to become the pioneers in this scientific experiment. The implications for the future of education are as significant as are our astronauts' experiments to the future of our space efforts.

This is the first full-scale scientific research of this type with high-school students. Those who are randomly assigned to participate will be providing continuous data in the same manner as did Conrad and Cooper. The experimental subjects will be asked to provide detailed reactions at the end of each session. Both experimental and control subjects will provide important test data.

We will count on those participating, in the same way we counted on the astronauts. Probably at times the latter would have liked to head back to earth, -- but they "stuck it out." Similarly, no matter what your feelings as you proceed, if you elect to be a possible subject and are so assigned, we will count on you to complete the entire "mission." There will be no getting out of the capsule! Other students who follow will be relying on your reactions and feedback on this mission.

However, it is important for me to stress that we will require no more than the two study periods a week. There will be no homework, no unexpected assignments. And we will expect similar reliability on your part in following through as agreed, if you elect to be included and are assigned in the "chance" process.

But, remember, you will not be traveling in an untried vehicle, as was pointed out in the information you read. College students and people from all walks of life from the U. S. and abroad have benefitted by courses and Institutes at "U.B." One high school senior, who had been enrolled by her father, later wrote an essay in school. I would like to read you one brief paragraph:

> During a high school summer vacation, I was fortunate enough to attend a Creative Institute at the University of Buffalo. What wonderful new areas of learning were opened to me there! I discovered secrets which my heavy textbooks hadn't contained. Of even greater significance I learned how to think freely and creatively.

Finally, you may be interested in a few reactions of one experimental freshman group at U.B.:

1. All 55 indicated they would recommend the course to all students.
2. 53 thought they would be able to apply the training in future life; 2 thought "possibly."

Here are a few of their specific comments:

"I have found different ways of doing problems. The course has taught me not to limit my thinking."

"It has benefitted me - not only with application to school problems but with other problems - at home, work, etc."

"It was well worth the time spent because I think I have developed a more conscious mind and searching attitude."

We will be most concerned with the reactions expressed by this first experimental high school group that we will now be working with in Buffalo!

Thank you!

D iii

COMMENTS BY DOROTHY ERISMANN TO PROSPECTIVE SUBJECTS

In view of the worldwide attention being focused on the subject of creativity, it is not surprising that we find frequent mention of creativity in our newspapers and magazines. You may have read in last week's papers of the girls in industry who required 138 hours to assemble a new electronic product. When management suggested that they try to simplify their work, they succeeded creatively in scaling the assembly time down to 57 hours. Thus they worked not harder, but smarter.

Possibly you read, also, the story of a Ford Motor Company employee formerly of Hamburg, New York, who gained for himself a new car and $6,000 in cash by being creative. While working as a stock checker in the paint mixing department he saw a way to save paint, time and money. He suggested that instead of purchasing primer paint by the barrel, it should be obtained by bulk tank trailer loads, stored underground in three 6,000 gallon tanks and pumped directly to the paint mixing room as it was needed.

Magazines, too, have been featuring articles on creativity. You may have read in the current issue (Sept. '65) of the Reader's Digest the second article, originally published in Think, entitled "How Good is Your Mental Health?" It is stated that the mentally healthy person is flexible under stress. When faced with problems he can see alternative solutions; he can come at his problems from varying perspectives.

The examples given indicate some of the ways in which the course in Applied Imagination may be of help to you.

Comments by the school Principals are outlined in the following memo sent to each Principal:

Millard Fillmore College

STATE UNIVERSITY OF NEW YORK AT BUFFALO

Formerly The University of Buffalo, Founded 1846

Director of Creative Education

Hayes Hall
Administration Road
Buffalo, New York 14214
Telephone 831 - 2208
Area Code 716

Dear

As discussed at our meeting on August 30, to keep the explanation of this experiment as uniform as possible, it is suggested that you incorporate the following ideas in your supporting statements, including the opening remark provided by Dr. Manch.

From Dr. Manch, Superintendent of Schools:

> "I have long been interested in the Creative Education program at "U.B." and have participated for several years in the June Creative Problem-Solving Institutes. Therefore, I am delighted that the Buffalo Schools have been selected for this experiment, which may have far-reaching consequences for all educational systems. Students taking part should benefit both themselves and the research project."

From the Principals:

Buffalo -- recognized as a world center in development of creative abilities

Buffalo schools, adjacent to this center; hence, fortunate to have been invited to participate in experiment

Should be valuable to participants as well as most worthwhile in the information it will furnish to our nation's educational efforts

Must attend all test sessions, if assigned

Classes will be regularly scheduled, for the assigned

We are applying to the Board of Education for ½ hour credit for this course, which would be graded S or NS

Questionnaire for prospective subjects D v

Name ____

Last First Initial

Address ______________________________________ Zipcode 142 __ __

Telephone ________________ Sex ________________ Date of Birth ________

Name of School ______________________________ Homeroom ________

SCHEDULE OF VACANT AND PHYSICAL EDUCATION PERIODS
(Place large X in space representing each free period.
Write "P.E." for each of your physical education periods.)
Circle "E" for early, or "L" for late on lunch period.

	Monday	Tuesday	Wednesday	Thursday	Friday
1					
2					
3					
4	E L				
5	E L				
6					
7					
8					

I. I intend to continue my formal education after graduation at (check type):

____ 1. college
____ 2. junior or community college
____ 3. business school

____ 4. art school
____ 5. technical school
6. other ________________

II. I have had the following experiences (check "yes" or "no" for all five items):

1. Have taken creative writing..yes__ no__
2. Am now scheduled to take creative writing........................yes__ no__
3. Have heard speakers or demonstrations on creative problem-solv. yes__ no__
4. Have read books on creative problem-solving......................yes__ no__
   Name(s) if known:
5. Have read articles on creative problem-solving...................yes__ no__

III. Other courses or activities I have undertaken that were especially designed to help make me more creative: (space was provided here)

IV. Extra-curricular activities (space was provided here)

V. Job activities (space was provided here)

VI. Hobbies (space was provided here)

I wish my name to be included among those from whom subjects for the experiment are randomly selected. I will accept whichever of the four assignments I receive (as summarized on page 4 of the explanation) .... yes _____ no _____

E-1

Millard Fillmore College
STATE UNIVERSITY OF NEW YORK AT BUFFALO
Formerly The University of Buffalo, Founded 1846

Director of Creative Education

Hayes Hall
Administration Road
Buffalo, New York 14214
Telephone 831 - 2208
Area Code 716

September 22, 1965

Mr. Nelson Mercer
Board of Education
City Hall
65 Niagara Square
Buffalo, New York

Dear Mr. Mercer:

You will be pleased to know that 1086 "college-prep" seniors in your eight academic high schools expressed a desire to be considered for the creative education experiment. Our random procedures have resulted in 335 being assigned as subjects, including both "experimentals" and "controls." Hence we will be providing the course to at least that many students, either in the present term or in the spring. We hope we may also be able to do something for the others. We will, at the least, provide them with the copy of Applied Imagination, as promised to them earlier. Before spring we will be considering alternatives with respect to the unassigned students. All of them received letters like sample "A" enclosed. Sample "B" (enclosed) went to all 335 students who were randomly assigned to the experiment.

As per my phone conversation, the following members of my staff are assisting with the testing in the experiment. Several will also assist with the proctoring of the programmed-instruction groups:

1. Mr. Gene Brunelle
2. Mrs. Dorothy Erismann
3. Mrs. Virginia Flint
4. Dr. Ruth Noller
5. Mrs. Beatrice Parnes
6. Mr. William Stockfield

All of the above are mature and responsible persons, who are serving as research assistants or associates in the project.

Mr. Nelson Mercer September 22, 1965

The additional persons were necessary because of the inclusion of all eight schools and because of the clustering of the testing in the morning periods, primarily on Tuesday and Thursday. From the standpoint of the experimental design, however, the consistency of test periods is very good.

Your principals, guidance counsellors, and others have been extremely gracious and cooperative. It is a real pleasure to collaborate with the Buffalo Schools in this project.

As per the half-sheet enclosures, given to students at the end of testing, classes will begin next week for "experimental" students, and in the spring for "controls." We will continue to keep you informed.

Sincerely yours,

Sidney J. Parnes
Director

SJP:gap

cc: All principals
Dr. Manch
Dr. Hayes

SAMPLE "A"

Millard Fillmore College
STATE UNIVERSITY OF NEW YORK AT BUFFALO
Formerly The University of Buffalo, Founded 1846
Director of Creative Education

Hayes Hall
Administration Road
Buffalo, New York 14214
Telephone 831 - 2208
Area Code 716

September 20, 1965

Dear

We are sorry to report that your name was not one of those randomly assigned to be included in the creative education experiment this fall. As was explained earlier, the assignment had to be made on a "chance" basis in such a way as to meet all the requirements of the research design. Only 30 to 60 students could be included in each school during this term.

As we promised in our earlier explanation, we will, in the spring, offer you either the course or a complimentary copy of the textbook, Applied Imagination. We will be in touch with you in this regard before spring.

Thank you very much for your cooperation in this most important research project. We certainly hope we will be able to include you in one of our programs in the spring. We will also be happy to share the results of the experiment with you later.

Sincerely yours,

Sidney J. Parnes

Sidney J. Parnes
Director

SJP/bs

SAMPLE "B"

Millard Fillmore College
STATE UNIVERSITY OF NEW YORK AT BUFFALO
Formerly The University of Buffalo, Founded 1846
Director of Creative Education

Hayes Hall
Administration Road
Buffalo, New York 14214
Telephone 831 - 2208
Area Code 716

September 20, 1965

Dear

We are pleased to tell you that your name was one of those randomly assigned to be included in the creative education experiment this fall.

You will report for testing on Tuesday, September 21, and Thursday, September 23, during period   in room   . After taking the tests, you will be notified whether you are assigned as an experimental or a control student.

Those assigned as "experimental" students will continue with course sessions throughout the semester (twice a week, in the same room and at the same periods as indicated above). "Control" students will report at the end of the semester for final tests and will then be offered the spring-semester course.

Thank you very much for your cooperation in this most important research project. We will look forward to having you participate in the testing this fall, and in the course either this fall or spring, depending on whether you are assigned as an "experimental" or a "control" student.

Sincerely yours,

Sidney J. Parnes
Director

SJP/bs

Name:

You have been randomly selected to be an experimental student in the creative education experiment.

Please report each Wednesday and Friday to room ____ during period ______.

Please bring this slip with you to the first class on Wednesday, September 29.

Name:

You have been randomly selected to be a control student in the creative education experiment.

At the end of this semester you will be notified as to the dates and place for the final testing. At that time you will receive further information concerning the second term course.

Name:

Your school has been randomly selected to be a control school in the creative education experiment.

At the end of this semester you will be notified as to the dates and place for the final testing. At that time you will receive further information concerning the second term course.

F

COURSE CONTENT

The pages in this section give information regarding the experimental creative problem-solving course.

The 28 booklets themselves, for use in the 26 sessions listed in F iv, have been sent separately to the Title VII office of the Office of Education. The majority of the content of the 28 booklets is available in a different format from the Creative Education Foundation, 1614 Rand Building, Buffalo, New York. It is in the form of an Instructor's Manual and Student Workbook for Creative Problem-Solving Institutes and Courses. The Manual and Workbook provide the kind of material that the teachers in the "instructor-taught" courses used for the present experiment (except that some of the problems and examples have been changed to be more appropriate for college and adult groups).

APPLIED IMAGINATION AND PROBLEM-SOLVING[1]

Introduction to Course

Change is bewilderingly rapid in our nuclear and space age -- more rapid than ever before. The discoveries and innovations of the next 20 years will probably make the previous 100 years seem to have progressed at a snail's pace.

Therefore, a student cannot foresee exactly what knowledge he will need five or ten years from now to meet life's problems. He can, however, develop attitudes and abilities that will help him meet any future challenge creatively by finding better solutions to problems. The objective of the creative problem-solving course is to help the student do just that. He learns to associate in new ways the knowledge and experience he possesses, as well as the new knowledge and experience he acquires throughout his education and his life. Thus he becomes better able to apply his learning to problems he meets as he progresses through school and into the future.

NATURE OF COURSE

The purpose of the course will be two-fold: First, to nurture your personal creativity; second, to enable you to express creative decisions. Creative decisions are dependent on creative observation, observation unhampered by habit.

The course is devoted to the practical application of creative processes. The creative process as applied to problem-solving is essentially as follows:

1. Fact-finding:
    a. Problem-definition--picking out and pointing up the problem.
    b. Problem-preparation--gathering and analyzing data.
2. Idea-finding:
    a. Idea-production--thinking up all possible leads to solution.
    b. Idea-development--reprocessing the resultant ideas by such means as modification and combination.

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[1] A Research Project supported by the U. S. Office of Education, Grant No.7-42-1630-213
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3. Solution-finding:

    a. Evaluation--verifying the tentative solutions, by tests and otherwise.

    b. Adoption--deciding on and implementing the final solution.

This course will be quite different from most courses you have taken. You will not be asked to "give back information." Rather, you will be asked to think up ideas -- your own ideas -- regarding a variety of problems in need of solutions.

At first, because of the nature of your previous education and experience, you may find this strange. But, as the course progresses, you will become accustomed to applying your creative imagination deliberately and energetically.

During the entire course a "learn by doing" atomosphere will prevail. Thus you will act creatively by meeting challenges and solving problems during the course.

In brief, the course will proceed in the following manner: You will learn by self-demonstration some of the internal and external factors which cripple imagination. A variety of procedures for overcoming these blocks to creative thinking will be presented, and you will participate in brief exercises employing those procedures.

When the course is over you will have a clearer understanding of how to tackle a problem creatively, as well as an appreciation of some of the rewards for creative effort. Also, you will express more freely your creative self.

OBJECTIVES OF COURSE

The following are some of the results this course will help you produce:

1. An attitude of self-confidence in your ability to be deliberately creative.

2. A strong motivation to utilize your creative potential.

3. An open-mindedness to ideas of others.

4. A greater expression of your curiosity -- an awareness of the excitement and challenge in life.

5. A consciousness of the vital importance of creative effort -- in business, in the arts, in the professions, in scientific and technical pursuits, and in personal living.
6. A heightened sensitivity to the problems that surround you -- an attitude of "constructive discontent" towards situations as they exist in your life (that is, a constant desire to improve everything that you do).
7. An increase in abilities associated with creativity, especially the ability to produce quality ideas and original ideas as leads to solutions of problems.

The course will be interesting and fun. It is fun, but it is not for fun. It is for keeps! It will have a tremendous impact on all of your activities during your future life, as well as during your school days.

The course itself will provide the kind of "climate" that will be necessary for acomplishing its purpose. It will be up to you to provide the "internal climate" most conducive to best results. This will involve, on your part, a willingness and commitment to look open-mindedly at every phase of the course, as well as a willingness to re-evaluate some of the opinions, attitudes, and habits that you have cultivated throughout your life.

CONCLUSION

Twelve years ago the noted psychologist, Dr. J. P. Guilford, insisted: "Like most behavior, creative activity probably represents, to some extent, many learned skills. There may be limitations set on these skills by heredity; but I am convinced that through learning one can extend the skills within those limitations." Research has now confirmed Dr. Guilford's conviction that creative talent (at whatever level this gift exists in an individual) can be nurtured deliberately.

Creative problem-solving is thus an art, a skill. It takes practice like any other skill. In swimming, we may be able to swim fairly well but not be skillful swimmers. If we discover, by lessons or otherwise, the key points of skillful swimming, and then practice them, we are more likely to become skillful swimmers. In learning to swim, most of the time is spent in practice. The same is true of piano-playing, or of any other skill. Similarly, it takes practice to develop and to improve one's creativeness.

Research has shown that one can learn to recognize and call deliberately on his creative abilities; and he can learn techniques of so doing. The net result for the student can be increased productivity. He may experience the same type of result as when a governor is taken from an automobile which has been held under 50 miles an hour; it now can travel 80 or 90. The motive power is the same, but the output has been enhanced. Similarly, this course will help you step-up your creative output.

*SELF-INSTRUCTIONAL COURSE IN APPLIED IMAGINATION

State University of New York at Buffalo

How to Use these Self-Instructional Aids

INTRODUCTION:

You are about to engage in what will probably be an entirely new experience for most of you. This is a type of self-teaching called programmed instruction. There are many reasons why you may find this one of the most rewarding kinds of learning. You will notice that you move along at your own most comfortable speed -- rapid, medium, or slow, as best suits you. Another "plus" for programmed instruction is that instead of answering just once or twice in a period, you are called upon to react to every sentence. Can you see the advantage in this? You are actively engaged in the learning process. Furthermore, you are not left to wonder whether or not you are thinking correctly, for on the back of every page (while you are learning fundamentals) you will find possible answers.

INSTRUCTIONS:

The title of each session gives a clue as to the nature of the session. The quotations on the cover are significantly related to the material included in the booklet. Therefore, be sure to read the title and quotations at the beginning of each session. Then, at the end of the session, look back at the cover and ask yourself, "Did I gain anything in relation to the topic and the obvious purpose of the session?"

In each booklet, read page 1, then write your response in the space provided. The length of the blank line does not bear any relationship to the size of the word or phrase you may use. Your response may be a word, a phrase, or any response that makes sense to you in completing the statement. Then turn over the page. On the reverse side of the same page you will find some suggested responses for page 1 (sometimes two or three, sometimes many alternative ones). No matter how few or how many are given, yours may always be still an additional response-possibility.

Compare the given responses with yours, then turn to page 2, read and respond in the same manner, and continue in this way until the last page of the program. If a page does not call for a written response, move right on to the next page.

There is always more than one satisfactory response to a particular "blank." Therefore, suggested responses will end with "etc.", indicating that many other responses might also be put in the blank space. You may find you do not agree with any of the responses given, for it is possible for you to create better responses than those given. In such cases, we both will probably recognize them as such. As a matter of fact, our suggested responses will usually consist of the words that are most frequently given by the students. But you may think of less common words or expressions, and this is fine. Such fluency and flexibility of word usage is in itself creative exercise. It is the sense of the statement that is important. You will undoubtedly realize whether you have made good sense in the context of the preceding and following pages. The purpose of the "blanks" is to make you think through the statement, -- to "engage" you in active reading, -- as well as to provide feedback for us.

Many pages will be "open-ended." They will not "clue" your responses, but will allow you to write freely with respect to what is requested. Also, many pages will not provide a suggested response on the reverse side. In such cases, you will find that your own response will undoubtedly be reasonable to you, and you will acquire confidence in your ability to respond appropriately to a variety of unusual tasks. Sometimes you may wish we had shown a few samples of others' thinking where we do not do so. In this case we suggest you talk with family or relatives and compare your ideas with theirs. You will probably find this especially interesting. However, please do not have such discussions with students who might be "control" subjects in this experiment!

Feel free to write a comment or suggestion on a page if the thought or exercise on that page bothers you in any way -- or make a note right then on the questionnaire at the end of the booklet. (One often forgets his comment if he waits until later.)

It is important to do each page in its proper turn. Please do not look ahead for the printed response before filling in your own. If you do not seem to be able to respond, leave the space blank. Likewise, do not later fill in, add to, or change any of your responses, regardless of how they may differ from the printed ones you find on the reverse side of the page. It is all right to look back in the booklet to review, but please do not change any earlier responses you made. It is important for us to know wherein you differed in your responses, or where you ran into difficulty. This aids us in refining and improving the program. And, as noted above, your response may be better!

If you become fatigued, take a "stretch-break" -- relax a moment. You may want to close your eyes and relax for a minute or two before the "buff" pages at the end of each booklet. These buff pages are included because we all proceed at our own speeds. Hence, some students may finish the basic part of the booklet faster and will find added challenge in the buff pages. Therefore, don't worry if you do not get to do them in class. As a matter of fact, any student may tear these pages out and take them with him if he would like to try his hand at them later.

F iii

(Outside of card)

EVALUATION
(solution-finding)

Effect on objective?

Individuals and/or groups affected?

Costs involved?

Tangibles involved (materials, equipment, etc.)?

Moral and/or legal implications?

Intangibles involved (opinions, attitudes, feelings, aesthetic values, etc.)?

New problems caused?

Difficulties of implementation and follow-up?

Repercussions of failure?

Timeliness?

IMPLEMENTATION
(acceptance-finding)

ACCEPTANCE: In what ways might I gain acceptance?
ANTICIPATION: How might I overcome anticipated objections?
ASSISTANCE: In what ways might other persons or groups help me?
LOCATIONS: What places or locations might be advantageous?
TIMING: In what ways might I use special times, dates, etc.?
PRECAUTIONS: What measures might test my "best" idea?

"A stitch in time saves nine!"

State University of New York at Buffalo
COURSE SUMMARY OF "APPLIED IMAGINATION"
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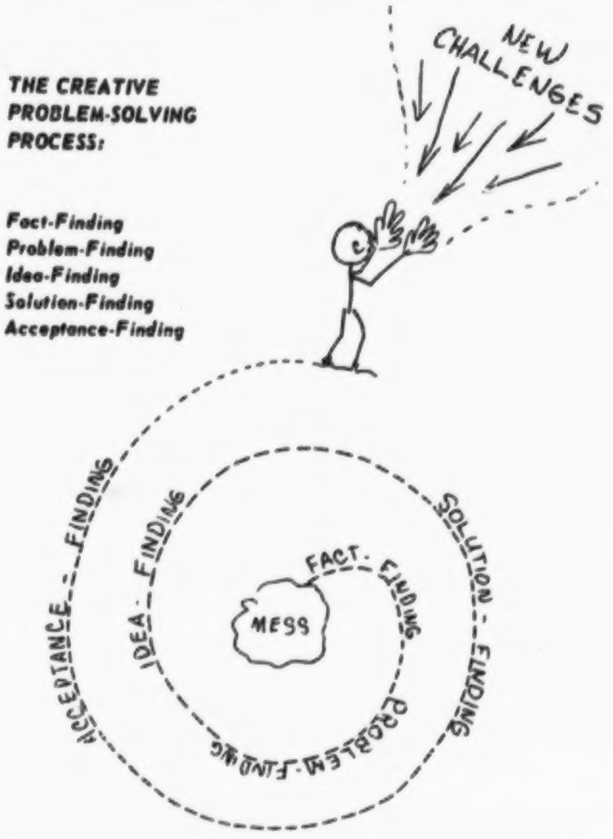
THE CREATIVE PROBLEM-SOLVING PROCESS:

Fact-Finding
Problem-Finding
Idea-Finding
Solution-Finding
Acceptance-Finding



> "Every goal man reaches provides a new starting point, and the sum of all man's days is just a beginning."
>
> Lewis Mumford

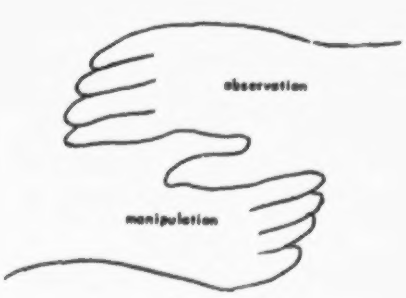
(Inside of card)

SENSITIVITY TO CHALLENGES
(problem-finding)

friends?
family?
neighbors?
church?
house?
school?
homework?
graduation?
car or transportation?
social life?
personality?
hobbies & leisure time?
finances? (money)
plans & goals?
hopes & desires?
career?

improvements?
happiness & comfort?
misunderstandings?
complications?
waste or inefficiencies?
bottlenecks & routine?
attitudes?
anxieties or fears?
anger or disgust?
pet peeves & complaints?
safety?
economy?
performance?
durability?
appearance?
popularity?

OBSERVATION AND MANIPULATION
(facts) (ideas)



DESCRIPTIVE CATEGORIES
(fact-finding)

Objects

function
structure
substance
color
shape
texture

odor
sound
taste
magnitude
time
space

Situations

who
what
when

where
why
how

IDEA-SPURRING QUESTIONS
(idea-finding)

MAGNIFY?
MINIFY?
REARRANGE?

Put to Other Uses?
Adapt?
Modify?
Magnify?
Minify?
Substitute?
Rearrange?
Reverse?
Combine?

TITLES OF SESSIONS

#1 Sensitivity to Challenging Problems

#2 Recognizing the Real Problem

#3 The Creative Process and Incubation

#4 Habit and Creative Behavior

#5 Deferred Judgment

#6 Idea-Finding by Forced Relationships

#7 Evaluation

#8 Preparing to Put Ideas to Use

#9 Part A - Discovering Relevant Factors

Part B - Applying the Total Creative Problem-Solving Process

#10 Observation and Perception

#11 Observing Features or Characteristics Part I

#12 Observing Features or Characteristics Part II

#13 Part A - Breaking down the problem

#13 Part B - A Personal "Obstacle-Type" Problem

#14 Idea-Finding: Introduction

#15 Idea-Finding: Making strange Ideas Useful

#16 Idea-Finding: Manipulation by MAGNIFICATION

#17 Idea-Finding: Manipulation by minification

#18 Idea-Finding: Manipulation by Rearrangement

#19 Evaluation and Development of Ideas

#20 Applying the Total Methodology to Our Own Problems or Challenges

#21 Stretching our Observational Abilities

#22 Awareness through All of Our Senses

#23 Idea-Spurring Verbs Applied to a Situation

#24 Idea-Finding: Forcing Relationships Among Aspects of a Problem

#25 A Challenge to Anticipate

#26 Making "Snap" Decisions Creativel

FIVE-MINUTE TEST EXERCISES

Approximately once every four sessions one of the following five-minute exercises was given in all experimental sessions:

1. List ways you might improve a mailbox.

   You will have five minutes. Once you have begun, make any necessary assumptions, but do not ask any questions. Please begin.

2. Take five minutes to list ways to improve a desk calendar. (This one item is included in Booklet #5, as page 1 of the program.)

3. List ways to improve a bathtub:

4. List ways to improve a library:

5. List ways to improve a Christmas Card:

6. List ways to improve toothpaste:

7. List ways to improve a bed:

Students were told to keep a record of the number of ideas they listed on these exercises in order to study their progress. The exercises had been pretested and found to yield, on group averages, equivalent numbers of ideas per item.

SPECIAL INSTRUCTIONS DURING CERTAIN SESSIONS

Instructions to Programmed Groups in Session 3

I will reread to you this paragraph from the original instructions about using the self-instructional booklets:

There is always more than one satisfactory response to a particular "blank." Therefore, suggested responses will end with "etc.", indicating that many other responses might also be put in the blank space. You may find you do not agree with any of the responses given, for it is possible for you to create better responses than those given. In such cases, we both will probably recognize them as such. As a matter of fact, our suggested responses will usually consist of the words that are most frequently given by the students. But you may think of less common words or expressions, and this is fine. Such fluency and flexibility of word usage is in itself creative exercise. It is the sense of the statement that is important. You will undoubtedly realize whether you have made good sense in the context of the preceding and following pages. The purpose of the "blanks" is to make you think through the statement, -- to "engage" you in active reading, -- as well as to provide feedback for us.

Instructions to Programmed Groups in Session 4

1. A reminder, that in this programmed course, there is deliberately no discussion provided. You may have seen the newspaper article the other day which further emphasized this. The experiment will be comparing these programmed groups with other groups where there is discussion provided, as was explained in the earlier information given to all students.

One thing we would encourage you to do, however, is to discuss the concepts and experiences in the sessions with your fellow experimental students (not with other students because of the control subjects in the experiment) or with members of your family.

2. A reminder about the emphasis, in the introduction to the course, that practice will be a strong part of the program. The development of creativity takes practice, like any skill. Therefore, when you finish both the basic parts of a booklet and the buff pages, go back to all of the earlier challenges that required ideas. Extend yourself in thinking up additional ideas beyond the ones that you listed the first time. Use up all the remaining time of the period for this purpose. If you like, you may also spend some of the time thinking up alternate words for the words that are given in the responses.

3. On any of the pages where it says "you may take it with you if you like," you are to work on these pages during the class session, just like any other pages; then you may tear the page out and take it with you for further thought or just because you may want to keep it.

Instructions to Programmed Groups in Session 5

If you disagree with any statement or quotation that is given in a booklet, please feel free and encouraged to write your reaction on that page. Then be sure to call our attention to your comment, by page number, in the questionnaire on the last page of the booklet. Incidentally, some of your points of disagreement might be interesting points for discussion with your fellow experimental students or your family.

Comment to ALL Students in Session 20

It might be well at this point to emphasize the relationship between learning creative problem-solving and learning to drive a car. When you first learn to drive, you have to think very intently about exactly what you are doing with your hands and feet. You are very conscious of each movement you make. However, after you have driven for a while, you make the movements almost automatically -- subconsciously.

Relating that experience to your experience in this course, you can see that during the course you are learning to make certain "thinking movements" quite deliberately. Later you will probably find them to be subconscious, -- almost automatic with you.

Absentee form F vii

_______________, 1965

Dear ______________________________,

This is the work we covered in class today. Will you please complete it and bring it to our next session on __________________.

Please do not show the material to any students.

NAME ______________________________ SCHOOL ______________

QUESTIONNAIRE REGARDING EXPERIMENTAL COURSE IN APPLIED IMAGINATION
for
Buffalo High School Seniors

IMPORTANT: This course was an educational experiment. Many other students in the future will be affected by decisions that will be based on your reactions as the first "test pilots" of the present course. Therefore, your answers and comments on this questionnaire are highly significant. Please read each question carefully, and give serious thought to your answers and comments. Be completely frank in your appraisal. No one at your school will see these papers; only the research staff at the University will work with the questionnaires. Furthermore, your answers and comments will in no way affect your grade. All students who have been asked to fill out this questionnaire have received an "S" grade already for the course.

Please circle one reaction in each multiple-choice statement, and provide as much information as possible for each item.

1. I find myself more observant than before the course. (not at all) (very little) (somewhat) (a good deal) (a great deal)

   Comment: ______________________________

2. I find myself more open-minded to ideas of others than before the course. (not at all) (very little) (somewhat) (a good deal) (a great deal)

   Comment: ______________________________

3. I find that I am more prone to try different approaches to doing something or to attacking a problem than before the course. (no) (I doubt it) (not necessarily) (probably) (definitely)

   Comment: ______________________________

4. I find I tend to take more factors into consideration in making decisions than before the course. (no) (I doubt it) (not necessarily) (probably) (definitely)

   Comment: ______________________________

5. I find myself more self-confident than before the course. (not at all) (very little) (somewhat) (a good deal) (a great deal)

   Comment: ______________________________

6. I find myself a more active participant in discussions than before the course. (not at all) (very little) (somewhat) (a good deal) (a great deal)

   Comment: ______________________________

7. I find myself more inquisitive than before the course. (not at all) (very little) (somewhat) (a good deal) (a great deal)

Comment: ____

8. I find since taking the course that I tend to exert more effort in mental tasks rather than quitting so soon. (no) (I doubt it) (I don't know) (I think so) (definitely)

Comment: ____

9. I find myself more aware of problems and challenges than before the course. (not at all) (very little) (somewhat) (a good deal) (a great deal)

Comment: ____

10. I find myself better able to cope with problems than before the course. (not at all) (very little) (somewhat) (a good deal) (a great deal)

Comment: ____

11. I find I am better able to think up effective ideas than before the course. (not at all) (very little) (somewhat) (a good deal) (a great deal)

Comment: ____

12. I find I am better able to evaluate my ideas than before the course. (not at all) (very little) (somewhat) (a good deal) (a great deal)

Comment: ____

13. I find I am better able to develop my ideas and put them to use than before the course. (not at all) (very little) (somewhat) (a good deal) (a great deal)

Comment: ____

14. I have found the course helpful in my school studies. (not at all) (very little) (somewhat) (a good deal) (a great deal)

Comment: ____

15. I think I will be able to make use of what I learned in my education after high school. (not at all) (very little) (somewhat) (a good deal) (a great deal)

Comment: ____

16. I found the course helpful in my life's activities in general. (not at all) (very little) (somewhat) (a good deal) (a great deal)

Comment: ____________________

17. I think I will be able to apply what I have learned in this course in my future life. (no) (I doubt it) (maybe) (probably) (yes)

Comment: ____________________

18. As compared with my favorite high school course, I think this course will prove valuable in my life. (to a much lesser extent) (to a lesser extent) (about the same) (to a greater extent) (to a much greater extent)

Comment: ____________________

19. As compared with my high school courses in general, I think this course will prove valuable in my life. (to a much lesser extent) (to a lesser extent) (about the same) (to a greater extent) (to a much greater extent)

Comment: ____________________

20. I think the course should have been (eliminated as of no real value) (reduced in length) (about what it was) (expanded to more sessions per week) (expanded to a full year).

Comment: ____________________

21. I feel the training would be best if given (never) (in grade school) (in junior high school) (earlier in high school) (during the senior year when it was given) (in college).

Comment: ____________________

22. I think a course like this should be (not offered at all) (elective to colleg prep only) (elective to all students) (required of all college-prep students (required of all students).

Why? ____________________

23. I would recommend a course like this to (no students) (some students) (most students) (all students).

Why? ____________________

24. If I had fully realized the nature of the course when the experimental volunteers were sought, I probably would have volunteered to spend the semester on the sessions. (no) (yes)

Comment: ______________________________

25. I would have preferred to drop out of the course if I had been given the opportunity. (definitely) (at many points) (sometimes) (rarely felt that way) (never wanted to)

Comment: ______________________________

26. As compared with my favorite high school course, I found this course (much less interesting) (less interesting) (about the same) (more interesting) (much more interesting).

Comment: ______________________________

27. As compared with my high school courses in general, I found this course (much less interesting) (less interesting) (about the same) (more interesting) (much more interesting).

Comment: ______________________________

28. I found the sessions (much too repetitious) (too repetitious) (moderately repetitious) (slightly repetitious) (not at all repetitious).

Comment: ______________________________

29. I found the course as a whole (not at all enjoyable) (not very enjoyable) (so-so) (enjoyable) (very enjoyable).

Comment: ______________________________

30. Did you expect something of the course which didn't materialize? (yes) (maybe) (no)

Comment: ______________________________

31. In what ways, if any, did it surpass your expectations?

____

____

32. What parts of the course helped you most and how? ____________________

____

____

33. What is your best suggestion to make the course more valuable for high school students? ____________________

____

____

34. I would like to take an advanced course in Applied Imagination in college, if I had the chance to do so. (no) (I doubt it) (maybe) (probably) (definitely)

Comment: ____________________

35. I have discussed the course at home.(not at all) (very little) (somewhat) (a good deal) (a great deal)

Comment: ____________________

36. I have discussed the course with my friends.(not at all) (very little) (somewhat) (a good deal) (a great deal)

Comment: ____________________

37. Regarding the yellow "take-home" pages:

1. I worked on them (never) (rarely) (sometimes) (usually) (always)
2. I read them (never) (rarely) (sometimes) (usually) (always)
3. I (disliked them) (was neutral to them) (enjoyed them) (never looked at them, so I don't know)
4. I found them to be (useless) (of little help) (of some help) (of great help)

Comment: ____________________

38. I found the periodic five-minute tests to be (very discouraging) (discouraging) (without effect) (encouraging) (very encouraging).

Comment: ____________________

39. If the course has helped you solve particular problems in any of these areas, please explain:

Family: ____

School: ____

Work: ____

Church: ____

Personal: ____

Other: ____

40. I think this experimental course was ____________________________

41. I think this experimental course was not ____________________________

42. To summarize your true feelings about the course, pretend you are writing a "confidential" note to your best friend who has asked you to tell him or her about this course. What would you say? (Use the back of this page if you would like more space.)

43. If my best friend then asked me if he should take this course, I would say (definitely no) (no) (maybe) (yes) (by all means).

44. I am creative. (yes) (no) (I don't know)

Regarding Self-Instructional Booklets Specifically:

45. Before this course I heard or read about programmed instruction. (never) (very little) (some) (quite a bit) (a great deal)

46. My own previous experience with programmed-instruction material has been (non-existant) (very slight) (moderate) (appreciable) (extensive).

47. I found this form of instruction. (very distasteful) (distasteful) (acceptable) (pleasant) (highly enjoyable)

Comment: ________________________________

48. I believe that I learned through this form of instruction. (terribly) (poorly) (passably) (capably) (superbly)

Comment: ________________________________

49. If I had been given the opportunity to talk over the work in the booklets, I would have felt differently about the course. (no) (I doubt it) (maybe) (probably) (yes)

Comment: ________________________________

50. If you answered "yes," "probably," or "maybe" to #49, how often do you think discussions should be held? (after each booklet) (once a week) (every other week) (about once a month) (a few times during the semester)

Comment: ________________________________

51. If I had spent the same amount of time we spent in these classes in studying a regular textbook in Applied Imagination, with no instructor, I feel that I would have accomplished (much more) (more) (about the same) (less) (much less).

Why? ________________________________

52. As compared with the self-instructional booklets we used in the course, I think I would have enjoyed spend the time studying a regular textbook on the subject, with no instructor, (much more) (more) (about the same) (less) (much less).

Why? ________________________________

53. I would have preferred listening to lectures during (all sessions) (most sessions) (half of the sessions) (a few of the sessions) (none of the sessions).

Comment: ______________________________

54. If I wanted to learn more about creative problem-solving, I would use additional programmed instructional materials. (only as a last resort) (with much hesitation) (maybe yes, maybe no) (without much hesitation) (in preference over all other forms of instruction)

Comment: ______________________________

55. I think programmed instruction should be used in future courses in Applied Imagination. (never) (seldom) (occasionally) (often) (always)

Why? ______________________________

56. If someone were going to rewrite the program I took, I would recommend generally: (make most pages much harder) (make most pages harder) (leave them about as is) (make most pages easier) (make most pages much easier)

Why? ______________________________

57. Regarding single word fill-ins, what would you suggest? (Don't use at all) (Use sparingly) (Use about as is) (Use even more extensively) (Use entirely)

Why? ______________________________

58. Did it tend to discourage you when you found a different response than you had filled in on a page? (never) (rarely) (sometimes) (usually) (always)

59. What was your reaction generally, when you found different responses than you had written on a page?

____

60. It has been suggested that all response be left off the back of the pages, inasmuch as the responses the students write are almost always appropriate. What do you think of this idea? (very poor) (poor) (fair) (good) (excellent)

Why? ______________________________

61. On the reverse side, please write whatever additional comments you would like to make about the self-instructional booklets.

Final letters to Principals and volunteers

H-1

Millard Fillmore College

STATE UNIVERSITY OF NEW YORK AT BUFFALO

Formerly The University of Buffalo, Founded 1846

Director of Creative Education

Hayes Hall
Administration Road
Buffalo, New York 14214
Telephone 831 - 2208
Area Code 716

January 25, 1966

Mr. Lloyd Miller
Bennett High School
2875 Main Street
Buffalo, New York

Dear Mr. Miller:

To confirm our conversations regarding the post-testing of the students in the creative education experiment, this testing will be carried out in your school on Tuesday, February 1 and Thursday, February 3 during periods 1, 2, 3, 4E and 6 in rooms 105, 135, 169, 103 and 285 respectively. Mrs. Virginia Flint will be conducting the post-testing as she did last fall.

The enclosed letter is being sent to each of the control students, via their homerooms, to alert them to the post-testing. Also, the letter informs them to continue reporting to room 285 for the sixth period on Tuesdays and Thursdays for the entire spring term, during which they will be given the creative problem-solving course as promised to them earlier. Students presently taking the course have already been reminded of the testing.

Attached is the list of students to take the tests and the spring course. If possible, would you remind them over the loudspeaker on Tuesday and Thursday morning that "all students who were notified to take the creative education post-tests should report to the rooms during periods as instructed."

We are counting on full class-periods those two days, just as we had for the pre-tests. Our experiment has proceeded beautifully so far, thanks to the excellent cooperation of all the schools. Now we will be ever so appreciative of your help in seeing that nothing interferes with the all-important post-testing next week. If you think of anything which might shorten the periods or interrupt the testing, would you be good enough to phone my office (831-2208 or 831-3701).

If you have any questions at all, please don't hesitate to phone me. We appreciate so much your cooperation, and we hope to have some very interesting results to report to you and the Buffalo Schools after all of our test data is analyzed during the spring term.

* * *

Regarding those students who had volunteered for the experiment but were not randomly assigned as either experimental or control subjects, a separate letter will be provided, via the homerooms, at the end of the week of the post-testing. We will be sure to send you a copy of that letter, which will offer the students who were not subjects in the experiment a copy of the textbook, Applied Imagination, as we promised to do earlier.

Sincerely yours,

Sidney J. Parnes

Sidney J. Parnes
Director

SJP/bs
Enclosures

cc. to Joseph Manch
Norman Hayes
James Lanz

H-3

Millard Fillmore College
STATE UNIVERSITY OF NEW YORK AT BUFFALO
Formerly The University of Buffalo, Founded 1846

Director of Creative Education

Hayes Hall
Administration Road
Buffalo, New York 14214
Telephone 831 - 2208
Area Code 716

January 27, 1966

Dear ____________________,

As a control subject in the creative education experiment, you will report for final testing on Tuesday, February 1 and Thursday, February 3 during period in .

The first experimental creative problem-solving course ends this week in all Buffalo High Schools. Your final tests on February 1 and 3 will be crucial. They will make it possible to determine to what extent the creative ability of control students increases as a result of a semester's work in your senior year without any special creativity course. Test results will be used for research purposes, not for discussion of individual scores with teachers or administrators.

In the case of the experimental students (who just completed the special course), the research will enable us to determine to what extent their development in creative ability is increased by the course in creative problem-solving, as well as to what extent the results are influenced by different methods of presenting the course. Gains in the creative ability of the "experimental" students (the ones who took the course) will be compared with the gains of the "control" students (who did not take the course), in order to determine any beneficial effects of the course.

Therefore, the "control" student plays as important a part in the experiment as does the "experimental" student. If we learn that your creative ability increased to the same extent without a special course in creative problem-solving, it would indicate that it is not necessary to provide deliberate courses to strengthen creative ability. If, on the other hand, the students who took the course show greater gains in creative ability at the end of the semester than do the control students, the creative problem-solving course might well be worth offering regularly in high schools.

After taking the final tests, you will then be able to begin the creative problem-solving course immediately, as we promised. This will be given to you on Tuesdays and Thursdays in the same room and at the same time as the testing, for the balance of the school year.

Thank you very much for your cooperation in this most important research project.

Sincerely yours,

Sidney J. Parnes

Sidney J. Parnes
Director

SJP/bs

Millard Fillmore College
STATE UNIVERSITY OF NEW YORK AT BUFFALO
Formerly The University of Buffalo, Founded 1846

Director of Creative Education

Hayes Hall
Administration Road
Buffalo, New York 14214
Telephone 831 - 2208
Area Code 716

February 3, 1966

Dear

Last fall you volunteered, if randomly assigned, to take part in the creative education experiment in the Buffalo public high schools. It happened, as you recall, that your name was not one of those randomly assigned to be included in the experiment.

We promised to offer you later, either the course or a complimentary copy of the textbook, Applied Imagination. Therefore, if you would like to receive the book, please write me now, and we will see that a copy is sent to you.

As to the course, we will not be able to accommodate large numbers in the classes to be offered this coming term. However, if you are especially interested in taking the course, which will be offered to control students in the programmed (self-instructional) form, let me know when you write. Then, should there be any cancellations among the control students who are slated for the course this term, we would try to include you as a replacement. If not, we would keep your request on file in case some future opportunity should occur.

Thank you for your interest in the research project. If you would like a summary of the results when they become available, let me know.

Sincerely yours,

Sidney J. Parnes

Sidney J. Parnes
Director

SJP:ap

TABLE 1

Type I Schools: Correlations (Pretest Scores)

	Assoc. Fluency	Other Uses	Conseq. Total	P.I. Fluency	Alt. Uses	P.I. Flex.	Conseq. Remote	P.I. Orig.	Planning Elab.	Apparatus	C.P.I. Dom.	Sex
Assoc. Fluency		.27**	.40**	.30**	.35**	.08	.32**	.23**	.34**	.20*	.10	-.16
Other Uses			.50**	.50**	.57**	.26**	.43**	.37**	.34**	.47**	.29**	.03
Conseq. Total				.62**	.46**	.39**	.66**	.48**	.52**	.51**	.21*	-.06
P.I. Fluency					.54**	.61**	.45**	.77**	.47**	.48**	.26**	.07
Alt. Uses						.28**	.42**	.41**	.47**	.56**	.21*	.12
P.I. Flex.							.26**	.53**	.31**	.28**	.19*	.09
Conseq. Remote								.38**	.36**	.36**	.11	-.07
P.I. Originality									.33**	.37**	.21*	-.02
Planning Elab.										.44**	.16	.03
Apparatus											.21*	.04
C.P.I. Dom.												.14
I.Q.	.22**	.14	.15	.08	.09	.06	.10	.17*	.13	.16	.16	-.14

Note.-- For each cell, sample size = 141[1]; and r significant at .05 level = ± .166, and at .01 level = ± .216.

* Significant at .05 level.
** Significant at .01 level.

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[1] Includes one additional control school mentioned in the Method section.

TABLE 2

Type II Schools: Correlations (Pretest Scores)

	Assoc. Fluency	Other Uses	Conseq. Total	P.I. Fluency	Alt. Uses	P.I. Flex.	Conseq. Remote	P.I. Orig.	Planning Elab.	Apparatus	C.P.I. Dom.	Sex
Assoc. Fluency		.10	.37**	.30**	.44**	.33**	.32**	.31**	.36**	.33**	.10	-.29**
Other Uses			.32**	.29**	.58**	.18	.27**	.37**	.36**	.38**	.22*	.33**
Conseq. Total				.57**	.45**	.42**	.59**	.49**	.56**	.42**	.04	-.29**
P.I. Fluency					.41**	.60**	.35**	.82**	.45**	.44**	.09	-.33**
Alt. Uses						.13	.30**	.45**	.42**	.49**	.07	-.21*
P.I. Flex.							.30**	.48**	.35**	.33**	.11	-.30**
Conseq. Remote								.33**	.43**	.33**	.10	-.42**
P.I. Originality									.36**	.45**	.10	-.21*
Planning Elab.										.50**	.22*	-.28**
Apparatus											.17	-.29**
C.P.I. Dom.												-.07
I.Q.	.19*	.26*	.11	-.01	.11	.13	.24**	.09	.22*	.19	.13	.03

Note.-- For each cell, sample size = 115 (except for those involving Other Uses, where sample size = 92).
$r_{05} = \pm .183$, $r_{01} = \pm .239$ (for Other Uses, $r_{05} = \pm .205$, $r_{01} = \pm .267$).

* Significant at .05 level.
** Significant at .01 level.

TABLE 3

Combined Schools: Correlations (Pretest Scores)

	Assoc. Fluency	Other Uses	Conseq. Total	P.I. Fluency	Alt. Uses	P.I. Flex.	Conseq. Remote	P.I. Orig.	Planning Elab.	Apparatus	C.P.I. Dom.	Sex
Assoc. Fluency		.21**	.39**	.30**	.39**	.18**	.32**	.27**	.35**	.26**	.11	-.21*
Other Uses			.42**	.41**	.58**	.23**	.36**	.37**	.34**	.41**	.26**	.19**
Conseq. Total				.60**	.45**	.40**	.63**	.48**	.54**	.47**	.13*	-.15*
P.I. Fluency					.48**	.60**	.41**	.79**	.46**	.46**	.18**	-.10
Alt. Uses						.22**	.37**	.43**	.45**	.53**	.15*	-.02
P.I. Flex.							.28**	.50**	.33**	.30**	.15*	-.07
Conseq. Remote								.36**	.39**	.34**	.11	-.22**
P.I. Originality									.34**	.41**	.15*	-.12
Planning Elab.										.46**	.19**	-.10
Apparatus											.19**	-.11
C.P.I. Dom.												.04
I.Q.	.22**	.21**	.13*	.04	.11	.09	.17**	.13*	.18**	.17**	.16*	-.05

Note.-- For each cell, sample size = 256 (except for cells involving Other Uses, where sample size = 233).
$r_{05} = \pm .122$, $r_{01} = \pm .161$ (for Other Uses, $r_{05} = \pm .129$, $r_{01} = \pm .169$).

* Significant at .05 level.
** Significant at .01 level.

TABLE 4

Type I Schools: Correlations (Gain Scores)

	Assoc. Fluency	Other Uses	Conseq. Total	P.I. Fluency	Alt. Uses	P.I. Flex.	Conseq. Remote	P.I. Orig.	Planning Elab.	Apparatus	C.P.I. Dom.	Sex
Assoc. Fluency		.20*	.13	.19*	.31**	.08	.00	.07	.22**	.20*	.17*	-.09
Other Uses			.32**	.43**	.36**	.18*	.29**	.32**	.25**	.30**	.06	.20*
Conseq. Total				.38**	.36**	.28**	.47**	.25**	.25**	.25**	.01	-.04
P.I. Fluency					.24**	.58**	.18*	.53**	.31**	.27**	.01	.05
Alt. Uses						.22**	.21*	.22*	.18*	.34**	.06	-.15
P.I. Flex.							.27**	.42**	.08	.12	-.02	-.03
Conseq. Remote								.24**	.06	.13	-.01	.12
P.I. Originality									.11	.19*	-.03	.14
Planning Elab.										.26**	.01	-.06
Apparatus											.07	.10
C.P.I. Dom.												.03
Pre-test I.Q.	.06	-.03	-.04	-.04	.06	-.03	.06	-.04	-.01	-.06	-.03	-.14

Note.-- Sample sizes and significant r's same as in Table I.

* Significant at .05 level.
** Significant at .01 level.

TABLE 5

Type II Schools: Correlations (Gain Scores)

	Assoc. Fluency	Other Uses	Conseq. Total	P.I. Fluency	Alt. Uses	P.I. Flex.	Conseq. Remote	P.I. Orig.	Planning Elab.	Apparatus	C.P.I. Dom.	Sex
Assoc. Fluency		.19*	.15	.16	.29**	.14	.02	.01	.11	-.06	-.12	-.15
Other Uses			.11	.28**	.27**	.13	.11	-.10	.10	.04	.13	.10
Conseq. Total				.43**	.13	.32**	.36**	.10	.30**	.05	.11	-.31**
P.I. Fluency					.15	.48**	.15	.39**	.18	.00	.00	.05
Alt. Uses						.10	-.07	.23*	.22*	.11	.10	-.16
P.I. Flex.							.07	.29**	.19*	.02	.00	-.12
Conseq. Remote								-.09	.11	-.08	.10	.20*
P.I. Originality									.19*	.08	.00	.10
Planning Elab.										.18	.10	-.25**
Apparatus											.00	-.10
C.P.I. Dom.												.04
Pre-test I.Q.	.30**	.07	.06	.06	.16	-.07	-.09	.01	.02	-.20*	-.07	.03

Note.-- Sample sizes and significant r's same as in Table 2.

* Significant at .05 level.
** Significant at .01 level.

TABLE 6

Combined Schools: Correlations (Gain Scores)

	Assoc. Fluency	Other Uses	Conseq. Total	P.I. Fluency	Alt. Uses	P.I. Flex.	Conseq. Remote	P.I. Orig.	Planning Elab.	Apparatus	C.P.I. Dom.	Sex
Assoc. Fluency		.20**	.14*	.18**	.30**	.10	.01	.04	.16*	.08	.02	-.11
Other Uses			.22**	.35**	.32**	.15*	.20**	.09	.17**	.17**	.09	.15*
Conseq. Total				.41**	.26**	.29**	.42**	.18**	.27**	.17**	.05	-.15*
P.I. Fluency					.20**	.53**	.17**	.45**	.24**	.15*	.00	.05
Alt. Uses						.17**	.09	.22**	.20**	.25**	.08	-.15*
P.I. Flex.							.19**	.36**	.12	.08	-.01	-.07
Conseq. Remote								.07	.08	.04	.04	.16*
P.I. Originality									.15*	.14*	-.01	.12
Planning Elab.										.22**	.05	-.15*
Apparatus											.04	.02
C.P.I. Dom.												.03
Pre-test I.Q.	.18**	.03	.02	.02	.11	-.04	-.01	-.01	.00	-.12	-.06	-.05

Note.-- Sample sizes and significant r's same as in Table 3.

* Significant at .05 level.
** Significant at .01 level.

TABLE 7

Raw Post-test Means

	Type I Schools					Type II Schools				
Test	Prog.-Alone	Prog.-School Control	With-Inst.	Inst.-School Control	Control School	Prog.-Alone	Prog.-School Control	With-Inst.	Inst.-School Control	Control School
Assoc. Fluency	15.6	12.7	12.7	12.8	14.5	17.0	17.3	16.5	13.6	11.6
Other Uses	12.0	8.8	12.5	7.5	11.7	13.4	10.5	18.0	8.8	11.2
Conseq. Total	18.0	16.2	17.4	14.9	16.5	18.8	18.3	22.6	15.6	14.1
P.I. Fluency	14.2	11.2	16.0	11.5	13.1	15.8	12.3	19.0	13.3	12.3
Alt. Uses	17.9	17.9	18.7	15.7	16.2	21.2	17.5	19.6	15.5	15.2
P.I. Flex.	7.6	5.7	8.4	6.1	7.0	8.0	6.8	8.8	6.9	5.9
Conseq. Remote	7.2	6.5	7.7	5.7	6.5	7.9	6.5	9.2	7.6	6.5
P.I. Originality	4.6	1.8	4.3	2.9	4.1	5.3	2.3	6.8	4.1	2.8
Planning Elab.	12.7	10.6	13.2	9.8	11.9	13.0	11.1	15.0	12.4	10.4
Apparatus	8.1	8.1	8.4	7.6	7.4	8.5	6.8	9.2	8.3	6.8
C.P.I. Dom.	29.1	27.1	28.2	23.8	25.2	28.5	28.1	28.2	28.4	26.6

TABLE 8

Adjusted Post-test Means from Different Analyses

	Type I Schools							Type II Schools						
Test	Prog.-Alone		With-Inst.		Control School			Prog.-Alone		With-Inst.		Control School		
	A	B	A	C	A	B	C	A	B	A	C	A	B	C
Assoc. Fluency	15.9	16.1	13.4	13.2	14.1	14.2	14.0	16.3	16.4	16.1	16.0	12.1	12.3	12.0
Other Uses	12.6	12.8	13.3	13.0	11.3	11.3	11.2	13.3	13.3	17.2	17.4	11.1	11.1	11.0
Conseq. Total	17.8	17.8	19.1	18.8	16.1	16.2	15.9	18.0	18.0	21.0	20.8	15.3	15.5	15.1
P.I. Fluency	14.7	14.6	17.1	17.0	12.4	12.4	12.3	14.7	14.6	17.9	17.7	13.7	13.6	13.6
Alt. Uses	18.9	18.9	19.1	19.0	15.9	15.9	15.8	20.3	20.3	19.1	19.0	15.7	15.7	15.6
P.I. Flex.	7.5	7.5	8.5	8.5	6.9	6.9	7.0	8.0	7.9	8.7	8.7	6.1	6.1	6.0
Conseq. Remote	7.2	7.1	8.1	8.0	6.3	6.2	6.3	7.6	7.5	8.6	8.6	7.1	7.1	7.0
P.I. Originality	4.8	4.8	4.6	4.6	3.9	4.0	3.8	4.9	4.9	6.5	6.4	3.1	3.1	3.1
Planning Elab.	12.8	12.8	14.0	14.1	11.7	11.8	11.8	13.0	13.0	14.2	14.3	10.6	10.6	10.6
Apparatus	8.3	8.2	8.5	8.5	7.2	7.1	7.3	8.4	8.3	8.6	8.8	7.3	7.2	7.2
C.P.I. Dom.	28.4	28.0	27.9	27.6	27.1	27.0	26.7	28.2	27.9	27.3	27.0	26.9	26.6	26.6

Run A: Prog.-Alone, With-Inst., Control School.
Run B: Prog.-Alone, Prog.-School Control, Control School.
Run C: With-Inst., Inst.-School Control, Control School.